LANDIS & GYR

UNIVERSAL CONTROLLER VARIOPONT®
for heating, ventilating and airconditioning

RVF5

01 - 993 - 0611

Room 20° C.
Plug in 20-21°C
15/20 %

Room detector

Measure temperature at point in ducts after room temperature is re-established.

technical information

MP MASTER

Control system VARIOPONT RVF5

Technical Description

Summary

The central unit of the Variopont control system is the electronic modulating controller RVF5. This unit, in conjunction with a corresponding selection of detectors, setting units and plug-in units, can solve practically all control tasks in the heating, ventilating and air-conditioning field. The RVF5, in conjunction with the available selection of detectors, can be used for the control of temperature, humidity, pressure or pressure difference.
The design features of the system are:
— The controller RVF5 is only manufactured in one form. The large number of application possibilities are achieved by means of different bridge circuits, the components of which are fitted in the detectors, setting units and plug-in units.
— The RVF5 is equipped with two multi-stage amplifiers, by means of which greater sensitivity is achieved.
— Two similar control windings, which are magnetically separated, are used for the amplifier input which affect the output from both bridges simultaneously.
— Nickel or Platinum detectors are used for temperature control.
— For the purpose of obtaining average values for temperature control, several detectors may be connected in parallel.
— Detectors and setting units may be exchanged without restriction, a common calibration is not necessary.

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1. Measurement principle and manner of operation

The measured value is determined through the electrical resistor which forms the detector, any alteration of the measured value results in an alteration of the resistance. The adjustable desired value is also determined through a variable resistor, which is incorporated in the setting unit. The detector and setting unit are connected to the controller to form a Wheatstone Bridge, in the cross-connection of which is placed the control winding of the magnetic amplifier. Fig. 1 shows the basic circuit diagram for a simple temperature control system.
The controlled value measured by the detector is defined as the «actual value» and the value set on the setting unit is designated the «desired value». When the actual value deviates from the desired value the bridge becomes unbalanced, and a current flows through the control winding of the amplifier. The direction of the current is determined by the direction of the deviation and the output signal of the amplifier actuates the regulating unit to counteract the deviation.

For most temperature controlled plants the best results are obtained with a Proportional-Integral control system. The thermal reset arrangement of the RVF5 provides the PI characteristic of the controller. This operates on a separate winding of the amplifier, thus making the detector bridge circuit independent of the thermal reset. The thermal reset is also independent of the controlled value and may be adjusted over a wide range from zero upwards.

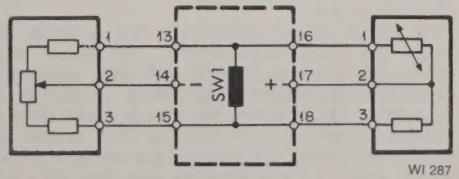


Fig. 1.1 Principle of a bridge circuit for temperature control

Many control tasks can be more satisfactorily solved by taking into account more than one measured value. Such

control tasks include disturbance value compensation (sliding control), anticipatory control etc. The Variopont control system is therefore designed to allow the connection of a second detector. For this reason a second bridge circuit is used and it is for this purpose that the amplifier is fitted with a second, identical control winding. Certain of the resistances for the second bridge circuit are also fitted in the detectors. The remainder of the circuit components are contained in a separate plug-in unit, which is plugged into a multi-pin socket in the controller. It is with the plug-in unit that the desired value, function and influence on the detector are determined. A small or a large plug-in unit may be required, depending on the application. The large plug-in units are adjustable but the small plug-in units are not, and therefore give a fixed function to the detector.
The controller is easily converted to a Proportional controller simply by inserting the appropriate plug-in unit. A feedback potentiometer in the control motor is connected, as is the case with a second detector, to the second bridge circuit and the second control winding of the amplifier. This plug-in unit provides facilities for the adjustment of the proportional band and its level.
The detector, the desired value setting unit and the plug-in unit, are ready matched to each other. If, for instance, a different setting range is required for a nickel temperature detector it is merely necessary to replace the desired value setting unit, the temperature detector remains unaltered. The reset method, P or PI, is also unaffected by the detector or setting unit. For simple control tasks the controller is used with only **one** detector. A plug-in unit is unnecessary for the majority of simple control applications, with the result that the multi-pin socket remains unoccupied. A second detector may be added at any time and does not involve any modification of the controller itself.
The VARIOPONT control system has been developed on the idea that those components which lead to the versatility of its application are not mounted in the controller itself, rather they are fitted in the detectors, setting units and the plug-in units. The controller itself is used in its standard form for all control tasks.

2. Controller design

2.1 Amplifier

In order to ensure that all the types of detectors used give the highest possible sensitivity response, the controller is fitted with two two-stage amplifiers. The input stage comprises two linear **magnetic push-pull pre-amplifiers.** These amplifiers have four control windings as well as the load windings, upon which they operate. One of these serves as a bias winding, and for the adjustment of the set point. Asymmetry in the amplifier may be corrected by adjustment of the potentiometer P3. A further winding is used for the thermal reset, and in addition two similar control windings are provided for the detector bridge circuits. One of these windings is connected to terminals of the controller and is placed in a cross connection of the main detector bridge circuit. The second control winding is also connected to terminals in the controller and to the multi-pin socket for the plug-in unit. This second control winding is placed in the bridge cross section of the auxiliary detector, or the reset potentiometer of a proportional control system.
The effects of the currents in the amplifier control windings are added algebraically. The output voltage of the pre-amplifier varies linearly with the resulting current.
A transistorized flip-flop amplifier, consisting of a double Schmitt trigger, follows the pre-amplifier. The duty of the flip-flop amplifier is to energise one or the other of the two output relays. By means of potentiometer P2 the operating point of the flip-flop amplifier can be adjusted, enabling the neutral zone of the controller to be varied in a ratio of 1 : 2,5. These controllers are delivered with the potentiometer P2 set to give the minimum neutral zone. Adjustment is required only in exceptional cases.

A contactless impulsing unit is used as **a fast response unit to shorten the control steps.** Small deviations of the actual value from the desired value result in minimum control steps of 0,7 to 1 second. In the absence of the superimposed impulses these steps would be considerably longer. The provision of this unit contributes to the fact that the control motor used need only have a relatively short running time, with a minimum of 2 minutes. The manner of operation of the impulsing unit is as follows: The energising current of the switched working relay is arranged to modify the bias current in the pre-amplifier. This counteracts the unbalance of the bridge and interrupts the control step prematurely. The **operating sensitivity of the amplifier** is $1{\cdot}8 \times 10^{-8}$ Watts. This corresponds to a control winding current of 10 micro-amps. The bridge circuits for temperature and pressure detectors are arranged to give a current of 10 μA in the cross-section for an unbalance of 1% of the range of the setting unit. In the case of humidity and pressure difference detectors, an unbalance of 2% is required to give the same current. Thus the sensitivity of the controller amounts to ±1% of the setting range with temperature and pressure detector and ±2% with humidity and pressure difference detectors.
The amplifier, of the d.c. controlled type, is unaffected by stray a.c. picked up on the detector circuit connecting leads.

2.2. Thermal reset

For PI control applications the controller is equipped with a separate built-in reset bridge circuit, in the cross-section of which is placed a control winding of the amplifier. The voltage feeding this bridge may be adjusted from 0 . . . 10 V by means of the potentiometer P1. The reset bridge contains two thermal reset resistances with nickel windings. When the controller operates because of a deviation of the actual value from the desired value, one of the output relays close and in doing so applies a heating voltage to one of the two reset resistances. The reset resistance heats up, unbalances the reset bridge circuit, and thereby energises its control winding in a sense opposing that of the detector control voltage. As soon as the effects of the two control currents are equal and opposite, the controller goes to its mid-off position. The reset resistance now cools off, again unbalancing the circuit causing the controller to operate again. This process continues, the controller switching periodically on and off with the result that the mean effect of the control current from the reset bridge circuit balances out the effect of a control current arising in the detector bridge as a result of a control deviation.
Used in conjunction with a control motor, which is operated by the controller, the thermal reset unit is responsible for the characteristic form of PI control. The proportional component can be adjusted within wide limits by varying the feed voltage of the reset bridge circuit. The resetting time is fixed by the cooling-time constant (140 secs.) of the reset resistance. The potentiometer P1 for the adjustment of the thermal reset is scaled 0 . . . 100%, this referring to the setting range for the temperature or pressure detector used. The scale values of the reset potentiometer must be multiplied by two for the humidity and pressure difference detectors.

2.3 Terminals

The controller is provided with 24 terminals and the layout of the connections has been arranged to minimize the number of loops required in the external wiring. The connections to the output relay contacts go to separate terminals, i.e. No. 5 and 6. This facilitates the wiring of minimum and maximum limiters, as shown in Fig. 2.3-1 . . . 2.3-3. Besides this, arrangements have been made, subject to suitable external circuitry, to prevent self-holding of the controller via one of the control contacts, a condition which is likely to occur when the plant has been shut down and the control motor receives a direct supply for the purposes of resetting. This is avoided by ensuring that the terminals 5 and 6 of the controller are separated from terminal 1 when the plant is shut down by means of the main switch. Examples of the wiring of the main switch are shown in Fig. 2.3-1 . . . 2.3-3.

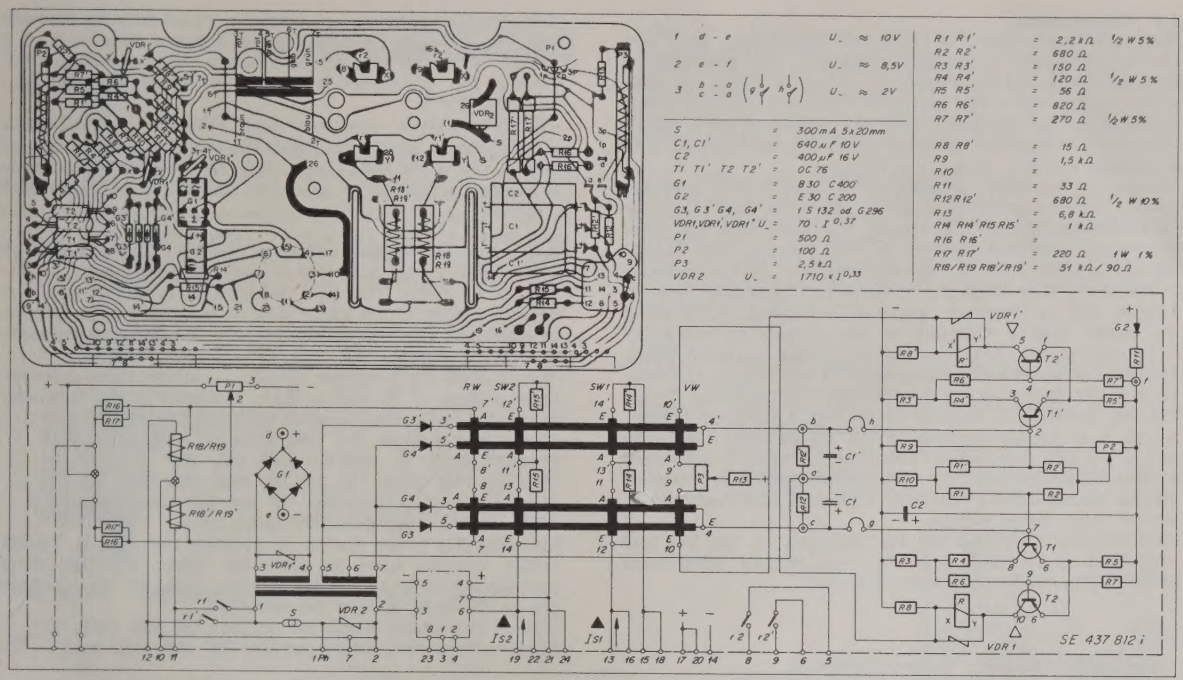
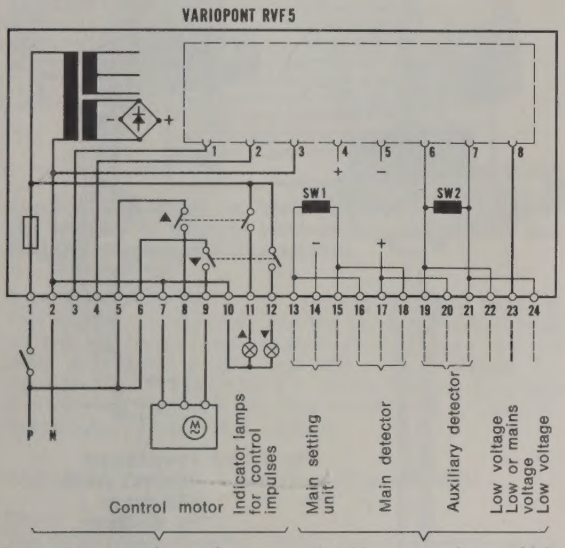


Fig. 2-1 Internal circuit of the controller



Connections remain unchanged except for terminals 3 and 4, which are for auxiliary connections and may be used for low voltage or mains voltage.

Variable connections which, however, are only used as indicated above.

Fig. 2.3-1 Terminal connections of the RVF5

Hand switch
I = ON
O = OFF

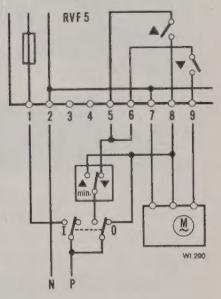


Fig. 2.3-2 Connections for a low limit

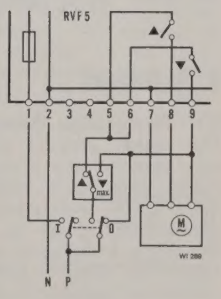


Fig. 2.3-3 Connections for a high limit

Indicator lamps to signal the control impulses may be wired to terminals 10, 11 and 12. Terminal 10 leads to the neutral, and the controller applies mains voltage to terminals 11/12 for the duration of the control impulses. The loading of terminals 11 and 12 is limited to 15 VA, for the current reaches them through the instrument fuse. This arrangement is essential because the resetting resistors are paralleled to the terminals in question. An indicator lamp unit for signalling the control impulses can be fitted in the desired value setting unit if required.

Generally speaking, terminals 1—12 are used for mains voltage, and terminals 13—24 for low voltage. Terminals 13—24 serve principally for the wiring of setting units and detectors. Terminals 3, 4 and 23 form an exception, as these may be used for either mains voltage or low voltage. They are connected to the socket for the plug-in unit. The amplifier control windings are directly connected to the controller terminals to which the bridge circuits of the detectors are wired.

2.4 Construction

The controller is fitted in a pressed sheet metal case and has no externally accessible adjusters. The controller is normally mounted in a cubicle or on a panel, a flush mounting version is not available. The terminals are below the body of the controller and are protected by a terminal cover. If required, a cable gland stirrup together with a suitable terminal cover is available.

Removal of the cover exposes the various circuit modules. All the heavier items, such as the mains transformer, the magnetic amplifiers, the relays, the fuse and the reset potentiometers are attached to the chassis. The socket for the plug-in units is likewise mounted on the chassis, between the two magnetic amplifiers. The smaller type of plug-in unit is installed simply by plugging in, whereas the larger type is clamped to the chassis by means of a knurled screw. A printed circuit board accommodates the smaller items and carries most of the wiring. Connections to the terminals are in wire. The potentiometer P1 for the thermal reset is located in the top right hand corner, where it is readily accessible for adjustment. The fuses are to the left, beside the reset potentiometer. Transparent plastic covers protect the two output relays. A moulded plastic shield covers the two thermal reset resistances, which carry mains voltage.

Potentiometers P2 and P3 are mounted on the left and right-hand sides and normally only require adjustment when the controller is being calibrated.

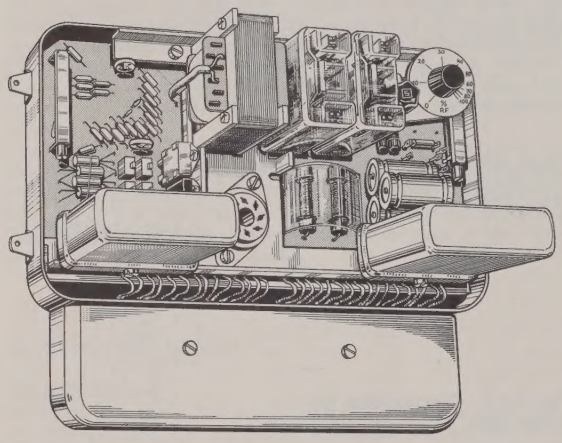


Fig. 2.4-1 RVF5 Controller, cover removed

3. Detectors

3.1 Temperature detectors with nickel sensing elements

The nickel sensing element of this type of temperature detector has a resistance of 100 ohms at 0°C. The mean temperature coefficient between 0 and 100°C is $6{\cdot}17 \times 10^{-3}$/°C, and complies with DIN 43760 standards and the table 9.1, page 15. Temperature detectors with nickel sensing elements are available in the following forms:

Immersion detector for liquids or air (Immersed length 120 mm)	QAE3r12
Immersion detector for liquids or air (Immersed length 200 mm)	QAE3r20
Immersion detector for air (Immersed length 450 mm)	QAE3r45
Cable type temperature detector	QAH3
Capillary type temperature detector	QAK3
Clamp-on temperature detector for pipes	QAD3
Outdoor temperature detector	QAC3
Room temperature detector with built-in setting unit, adjustable 5 . . . 35°C	QAA4rv
Room temperature detector	QAA4r

These detectors differ from other detectors principally in that they are fitted with an additional fixed resistance of 150 ohm. The temperature sensitive nickel sensing element and the 150 ohm fixed resistance together form half of a bridge circuit. A detector with nickel sensing element but without the additional resistance is not suitable for use with the RVF5.

The temperature detectors type QAE3r . . . , QAH3r and QAA4r are alternatively available with two sensing elements 100 ohms at 0°C. The type designation then includes two r's instead of one, i.e. QAE3rr . . . , QAH3rr and QAA4rr.

3.1.1 The temperature detector QAE3r . . . can be fitted either with a pocket for liquids or with a flange for mounting in air ducts. The type designation is unchanged, the detector being of the same kind in both cases. The range of application of the immersion type temperature detector is —30 . . . +160°C.

The pockets for the type QAE3r . . . temperature detector have a bore of 15 mm and are available in the following forms for immersion lengths of R=120 or 200 mm:

Nickel plated brass, ½" gas threaded seal, (ND 10)*
Steel St 35.29, ½" gas flat seal, (ND 16)*
Steel St 18/8 Cr/Ni, ½" gas flat seal, (ND 16)*
Steel St 18/8/2,5 Cr/Ni/Mo, ½" gas flat seal, (ND 16)*
*(ND means rated pressure kg/sq cm.)

Normally the brass pocket is supplied for use in liquids unless another form is specified. When stainless steel pockets are ordered the liquid, etc., in which the pockets are to be used should be specified.

Normal immersion length for liquids: 120 mm (200 mm)
Normal immersion length for air: 200 mm (450 mm)

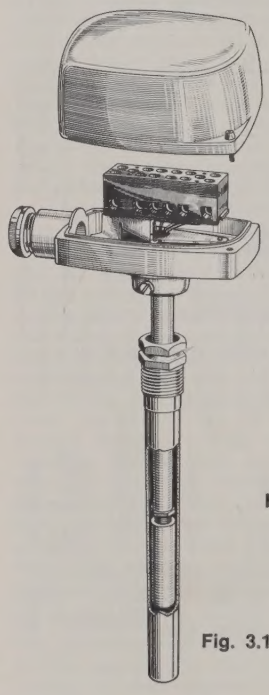


Fig. 3.1.1-1 Immersion temperature detector QAE3r . . . with pocket, for liquids

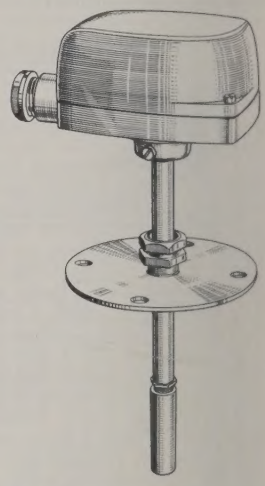


Fig. 3.1.1-2 Temperature detector QAE3r . . . with flange for air duct

3.1.2 The cable type temperature detector QAH3r is used when it is impracticable to install an immersion type detector. This may occur when the location is inaccessible or when an abnormally long immersion length is required. The QAH3 is alternatively available with an acid-resistant plastic coating. The cable type temperature detector has no connection head, a 3 meter (approx. 10ft) long flexible lead being sealed directly into the temperature sensing cartridge. The temperature range of the cable type detectors depends primarily on the cable used, the ordinary range being —30 to +90°C.

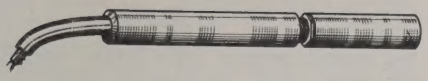


Fig. 3.1.2-1

3.1.3 The capillary type temperature detector QAK3r is primarily intended for use in ventilating plant in which the temperature is liable to vary over the cross section of the duct. In such cases the capillary is arranged so that its full length is distributed across the whole cross-sectional area of the duct and thus measures the mean temperature of the air stream. An example of the mounting method in the

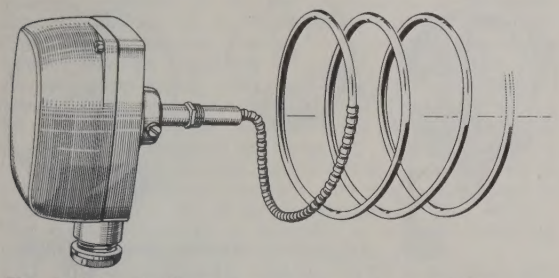


Fig. 3.1.3-1 Capillary temperature detector QAK3r

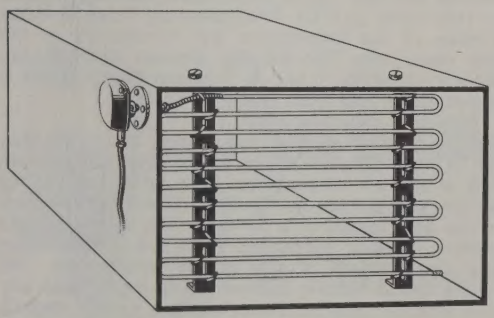


Fig. 3.1.3-2 Example of QAK3r installed in an air duct: the capillary is arranged between two slotted steel bars and well secured with wire binding.

duct is shown in Fig. 3.1.3-2. The capillary tube temperature detector is equipped with the same connection head as the immersion type detector QAE3r... and like the latter is mounted on the duct with a round flange. The capillary tube of the QAK3 is 6 meters (approx. 20ft) long and has a diameter of 3 mm. This detector may be used for temperatures from —30... +90°C.

3.1.4 The clamp-on temperature detector QAD3

3.1.4.1 Design

The temperature detector QAD3 has a moulded plastic housing, and is secured on to the pipe by means of a clamping band with tensioning device. The thermal coupling for the detector is made with a moulded aluminium block, which is pressed against the pipe by means of the clamping band. The moulded plastic housing insulates the detector windings against radiated heat. Thermally conductive paste is not necessary to give the required thermal coupling. A nickel wire winding is used as the sensing element and is mounted directly on the aluminium block.

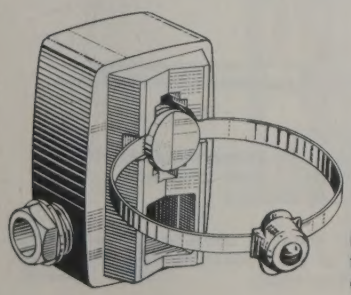


Fig. 3.1.4-1 Clamp-on temperature detector QAD3

3.1.5 Room temperature detector QAA4...

The room temperature detector QAA4... is fitted into a housing for wall mounting. It comprises a base-plate, the printed circuit, the desired value potentiometer and the cover, in which the sensing element is mounted. The sensing element is plugged into the printed circuit board when the cover is fitted.

Type:

QAA4r Room temperature detector with one nickel wire sensing element

QAA4rr Room temperature detector with two nickel wire sensing elements

QAA4rv Room temperature detector with one nickel wire sensing element and an incorporated desired value setting unit with a range of 5...35°C

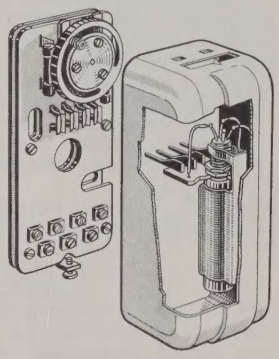
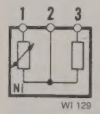


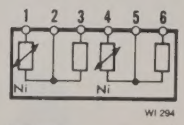
Fig. 3.1.5-1 Room temperature detector QAA4rv

Note

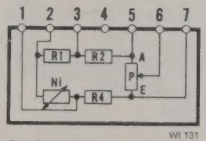
In connection with room temperature control it must be remembered that the very large thermal inertia of this kind of application renders it impossible to achieve control of the PI type when using only a single temperature detector. Adequate stability can only be achieved with proportional control but rather than use proportional control, it is better to adopt a control system of the anticipatory kind, whereby the flow temperature or the inlet air temperature is adjusted in relation to the room temperature. This method of control operates in a proportional manner for the room temperature; for the inlet air or flow temperature the RVF5 operates as a PI controller. This anticipatory form of control offers considerable advantages over the pure proportional control.



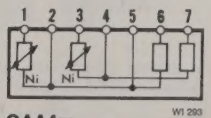
QAE3r QAC3
QAH3r QAA4r
QAK3r QAE3pt
QAD3



QAE3rr
QAH3rr



QAA4rv



QAA4rr

Fig. 3.1-1 Internal circuits of the temperature detectors

Note
Where it is necessary to obtain the mean temperature of two or more points, it is possible with the Variopont control system simply to parallel temperature detectors as indicated in Fig. 3A-1. The number of paralleled detectors has no significant effect on the calibration of the setting unit, but the paralleling of the units leads to certain other consequences:

a) As the number of paralleled detectors is increased, the sensitivity of the controller diminishes, see Fig. 3A-2.
b) In circuits employing a second bridge circuit the relative effect of the latter changes with the number of paralleled detectors in the main bridge circuit. The detector bridge circuits are designed to give a sensitivity of ±1% of the setting range.
If, now, the sensitivity of the main bridge circuit is diminished the relative effect of the auxiliary circuit is increased. The scales indicating the relative influence are based on the normal sensitivity of 1%. The changed sensitivity is readily calculated by multiplying the desired value on the influence scale by the sensitivity (in %).
For example: If four temperature detectors are paralleled in the main bridge circuit (see Fig. 13), the sensitivity is 1,45%. An influence setting of 20%, multiplied by 1,45, yields a resulting influence of 29%.
c) The sensitivity of the controller can be increased by paralleling the two control windings of the RVF5. It is necessary in this case, however, for only one of the bridge circuits to be connected. Curve b of Fig. 3A-2 shows the variation of sensitivity in relation to the number of paralleled detectors.

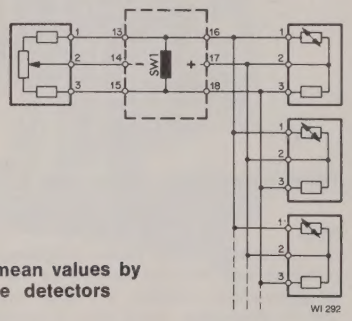
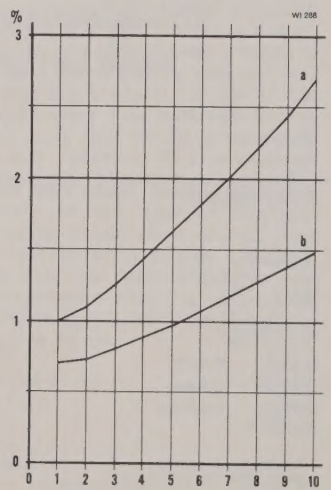


Fig. 3A-1 Obtaining mean values by paralleling temperature detectors



a Normal circuit with one control winding of the RVF5
b Both control windings of the RVF5 paralleled

Fig. 3A-2 Sensitivity of the RVF5 when temperature detectors are paralleled for the purpose of obtaining average temperatures.

3.1.6 Weather detector QAC3

3.1.6.1 Design

The weather detector QAC3 breaks down into three separate parts, which considerably simplifies the actual installation task. The base section with the connection terminals is made of plastic material. The detector insert is comprised of the sensing element winding encapsulated in Araldite, which makes it humidity proof. It has three connection lugs, with which it is secured into the base section. The arrangement of the connection lugs prevents any incorrect connection. The upper section, the cover, is of die-cast aluminium.

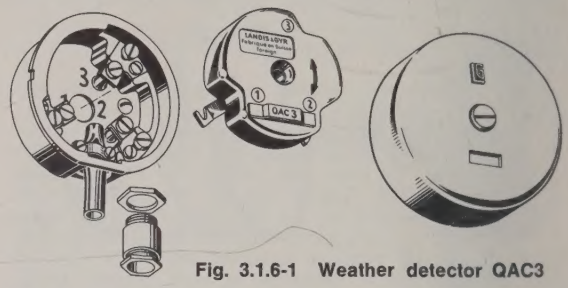


Fig. 3.1.6-1 Weather detector QAC3

3.1.6.2 Sensing element

The weather detector has a nickel wire winding sensing element (100 ohms at 0°C). The resistance value is taken as the value of the temperature and transmitted to the controller electrically. The sensing element lies between the detector terminals 1 and 2, between 2 and 3 lies a fixed resistance of 150 ohms (see Fig. 3.1-1).

3.1.6.3 Detection characteristics

The weather detector is mounted directly on to the outside wall. It measures 35% of the wall surface temperature and 65% of the air temperature. This ratio was chosen because the wall surface temperature contributes substantially to the heat losses of a building. The thermal inertia of a building is better accounted for in this manner, than by using measurement of only the air temperature. The temperature of the sensing element being higher than ambient, the weather detector becomes, to a certain degree, wind sensitive. With wind present the weather detector is cooled somewhat, so that it detects a lower value than without wind in the same air temperature. The controller therefore effects an increase in the flow temperature. Sunshine warms the weather detector and the outside wall, so that the controller effects a lowering of the flow temperature.

3.2 Temperature detectors with platinum sensing elements

The platinum sensing element is fused into glass, the resistance being 100 ohms at 0°C. The mean temperature coefficient between 0 and 100°C is $3{\cdot}85 \times 10^{-3}$/°C and corresponds to the series of resistance values in the table 9.2, page 15.

3.2.1 The immersion temperature detector QAE3pt20 is suitable for use with temperatures up to 250°C. It comprises a connection head, the sensing element and a steel pocket. An extension piece between the detector head and the pocket protects the detector head from excessive temperatures.

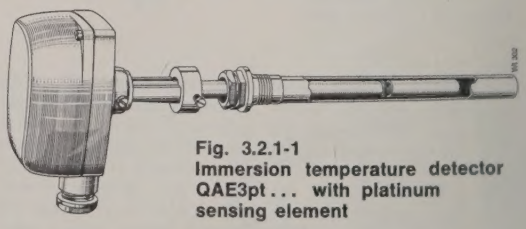


Fig. 3.2.1-1 Immersion temperature detector QAE3pt... with platinum sensing element

Where required, e.g. for warm air systems, a round flange may be fitted in place of the pocket. A 220 ohm resistor is fitted in the connection head.

It is also possible to use other resistance thermometers with platinum elements of 100 ohms at 0°C in accordance with DIN Standards, e.g. as manufactured by the Degussa Company. When such detectors are used, which do not have an auxiliary resistance fitted, it is necessary to fit the plug-in unit FZY1.102 into the RVF5. This contains the 220 ohm auxiliary resistance. By using such temperature detectors (of other manufacture) it is possible to consider applications where temperatures in excess of 250°C are experienced.

3.3 Air humidity detectors

The air humidity detectors contains an electrically heated lithium-chloride element, whose temperature forms an accurate measure of the partial pressure of the water vapour in the air, i.e. of the absolute humidity of the air. Fitted in the sensing element is a platinum resistance thermometer for measurement of the temperature. The corresponding setting unit is calibrated in terms of absolute humidity, i.e. gm of water per kg of dry air.
To control the relative humidity of the air it is necessary, in addition, to measure the actual air temperature. Thus, in addition to the humidity detector it is also necessary to provide a temperature detector. The range of control is then 20 . . . 100% r.h. at air temperature of 10 . . . 40°C.
The humidity detector is available in a room mounting form, and in a stem form for fitting into ducts.

3.3.1 The duct humidity detector QFB1 is provided with the same connection head as the stem type temperature detectors QAE3r . . . and is attached to the duct with a circular flange.

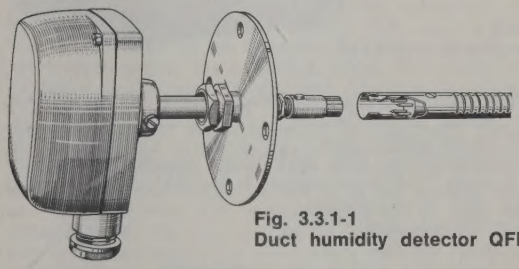


Fig. 3.3.1-1
Duct humidity detector QFB1

3.3.2 The room humidity detector QFC1 is shown in the Fig. 3.3.2-1.
The QFB1 and QFC1 are fitted with identical plug-in elements. These sensing elements are normally delivered enclosed in a sealed plastic packing. The sensing element should not be removed from its packing before the plant is actually ready for commissioning.
The heating circuit of the humidity detector is connected to the power pack EEV1, which is suitable for the operation of one or two detectors. In order that the lithium-chloride may not absorb moisture and dissolve, it is necessary for the sensing element to be kept permanently heated, even when the installation is out of use.

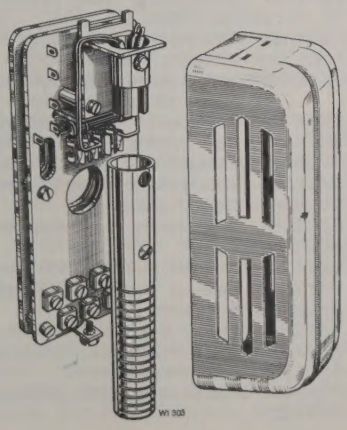


Fig. 3.3.2-1
Room humidity detector QFC1

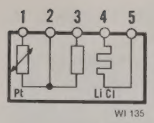


Fig. 3.3-1
Internal circuit of the humidity detectors

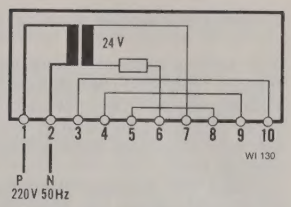
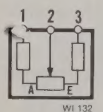


Fig. 3.3-2 Circuit of power pack EEV1

3.4 Pressure detectors

These consist of Bourdon movements with attached potentiometer. The potentiometer transmitter consists of a bar-type potentiometer with two resistances, which together form one half of a bridge circuit. The case is totally enclosed, has no indicating system and is provided with a ½" gas connection.



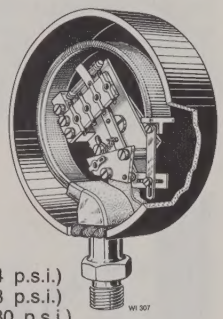


Fig. 3.4-1
Pressure detector QBD2

Pressure detectors are available for the following ranges:
QBD2.1 : 0 . . . 1 kg/sq cm (0—14 p.s.i.)
QBD2.5 : 0 . . . 5 kg/sq cm (0—73 p.s.i.)
QBD2.20 : 0 . . . 20 kg/sq cm (0—280 p.s.i.)
QBD2.6 : 1 . . . 6 atmos. abs. (0—88 p.s.i.a.)
(fluorine-chlorine refrigerants, Freons).
The QBD2.6 has been specially designed for use with Freon refrigeration plant. It may be overloaded to 16 atmos. abs. The other types can be continuously loaded over the whole of their ranges. Pressure detectors QBD2.1 and QBD2.6 are position-sensitive and must be mounted vertically, with the pressure connection underneath.

3.5 Pressure-difference detectors for air and neutral gases

The **QCG1** is used for the control of small negative or positive pressures in ventilated rooms, for the control of large air-duct systems and for the draught regulation in boilers operating with negative pressure in the combustion chamber. Being a thermal flow measuring device, the QCG1 operates without moving parts. It is fitted in a case for wall mounting and has two ½" gas connections on the right hand side. The range is determined by an easily changed orifice. The available ranges are: 0 . . . 1 mm WS (0 . . . 0·039 in.w.g.), 0 . . . 2 mm WS (0 . . . 0·078 in.w.g.), 0 . . . 5 mm WS, (0 . . . 0·195 in.w.g.), 0 . . . 15 mm WS (0 . . . 0·585 in.w.g.), 0 . . . 40 mm WS, (0 . . . 1·560 in w.g.).
The pressure-difference detector is provided with a built-in power pack and therefore requires its own mains connection.

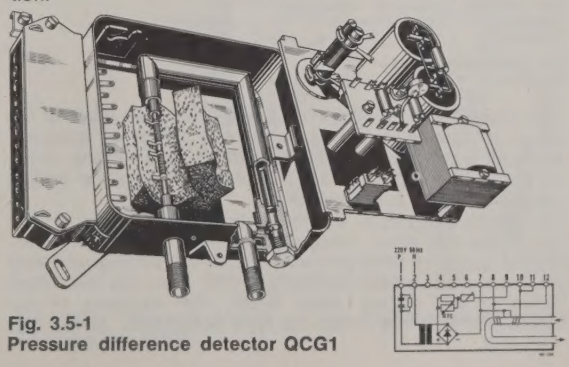


Fig. 3.5-1
Pressure difference detector QCG1

4. Desired value setting units

The setting units are adapted to the various types of detectors. The type designation indicates the measured magnitude and the upper value of the setting range. The basic form of the setting unit is made for flush panel mounting. Various additional fittings are available for use with these setting units:

— Case for surface mounting
— Wooden base for flush mounting in concrete
— Indicator lamp unit for indication of the control impulses
— Maximum and minimum stops
— Auxiliary switches for initiation of a switching operation when the setting unit knob is turned

The auxiliary switches are controlled by cams. The exact nature of the duty of the auxiliary switch must be made known to us at the time of ordering so that the correct cams may be fitted.

The front plate of the setting unit bears a printed scale and below the setting knob are two triangular windows. The indicator lamp unit is mounted behind these windows, whose arrow-head shapes indicate the sense of the control impulses. When an indicator lamp unit is not fitted, these windows are covered by a black adhesive strip bearing the inscription «LANDIS & GYR». The accessories in question are easily fitted to the setting unit.

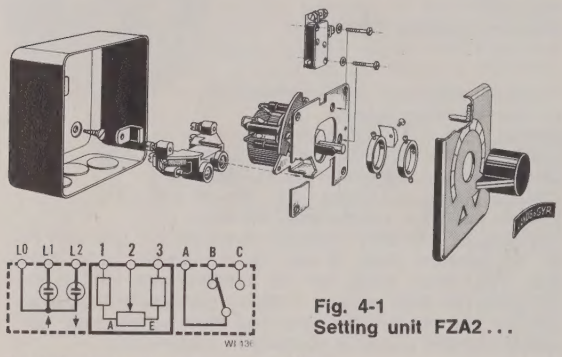


Fig. 4-1
Setting unit FZA2...

The following setting units are available:

For temperature detectors with nickel sensing element:

FZA2r10	Setting range	—30 . . . +10° C
FZA2r20	Setting range	—10 . . . +20° C
FZA2r35	Setting range	5 . . . 35° C
FZA2r60	Setting range	10 . . . 60° C
FZA2r120	Setting range	20 . . . 120° C
FZA2r160	Setting range	40 . . . 160° C

For temperature detectors with platinum sensing element:

FZA2pt200	Setting range	40 . . . 200° C
FZA2pt450	Setting range	150 . . . 450° C
FZA2pt850	Setting range	350 . . . 850° C

For pressure detectors:

FZA2p1	Setting range	0 . . . 1 kg/cm²
FZA2p5	Setting range	0 . . . 5 kg/cm²
FZA2p20	Setting range	0 . . . 20 kg/cm²
FZA2p6	Setting range	1 . . . 6 atmos. abs.

For air humidity detectors:

FZA2h16	Setting range	2 . . . 16 gm H_2O/kg (Abs. humid.)
FZA2h100	Setting range	20 . . . 100% r.h.

For pressure difference detectors:

FZA2dp100	Setting range	0 . . . 100% △p
FZA2dp50	Setting range	—50 . . . +50% △p

For positioning control:

FZA2z100	Setting range	0 . . . 100%

The percentage markings on the setting unit refer to the range of measurement, for example a range of measurement of 2 mm WS with FZA2dp100 gives a setting range of 0 . . . 2 mm WS; or with FZA2dp50 it gives a setting range of —1 . . . +1 mm WS.

As will be seen from the list of type designations of setting units, the small annexed characters indicate the particular group of detectors with which the setting unit may be used. The number following these indicates the upper value of the setting range scale. The additions of accessories does not effect the type designation of the setting unit.

5. Plug-in units

A plug-in unit serves principally for fixing the working point of a second detector. As already indicated, the components of the bridge circuits of the Variopont control system are installed in the detectors and the setting units. The plug-in unit contains the remaining bridge components for the second detector. Control duties involving only one detector and its setting unit normally require no plug-in unit. Exceptions are provided by proportional control, the potentiometer fitted to the control motor taking the place of a second detector and by the use for a platinum temperature detector which has no auxiliary resistance fitted in the head.

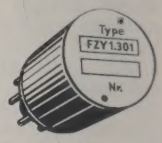


Fig. 5-1 Small plug-in unit FZY1...

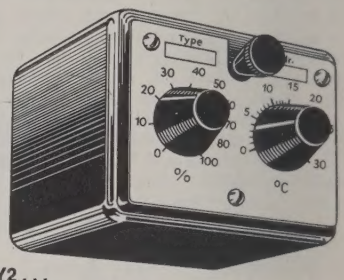


Fig. 5-2
Large plug-in unit FZY2...

The type designations for the plug-in units are as follows:
FZY1. Small plug-in unit
FZY2. Large plug-in unit

The supplementary type designation consists of a three digit number. The significance of the first digit following the full stop is as follows:

1 Temperature control
2 Humidity control
3 Light-sensitive control for greenhouses
4 Proportional control

The second and third digits after the full stop are serial numbers commencing with 01.

A small plug-in unit type FZY1 normally contains resistances and wire connections. A large plug-in unit type FZY2 generally also contains adjusters, such as potentiometers, and sometimes also relays, etc. Adjusters in the plug-in units are intended for the initial adjustment when commissioning the plant, and to gain access to them it is necessary to remove the cover of the controller. The type designations of the plug-in units and their functions are indicated in the following list:

Temperature control

FZY1.101	anticipatory room temperature control for radiator heating
FZY1.102	for platinum sensing elements without the auxiliary resistance
FZY1.103	temperature difference control with 2 nickel temperature detectors
FZY2.101	anticipatory room temperature control for radiator heating systems, with night reduction
FZY2.102	constant and compensated temperature control
FZY2.103	anticipatory room temperature control for ventilating plant
FZY2.104	progressive compensated temperature control

Humidity control

FZY1.201	relative humidity, PI control
FZY2.201	relative humidity, anticipatory

Proportional control

FZY2.401	temperature or pressure control
FZY2.402	air humidity or pressure difference control
FZY1.401	positioning control

Pressure difference control with two QBD2...

FZY1.501

6. Low limiter

6.1 Construction

The limiter QAX1 is built into a housing which also serves as a connection head. Fig. 6.1-1 shows the construction of the limiter. The diecast aluminium housing is painted and is supplied with a cable entry gland Pg 13.5. Beneath the housing cover are found the two setting knobs for the operating temperature and the influence. A printed circuit board carries the greater part of the circuit components and connection terminals. On the lower part of the stem are the two sensing elements, which are temperature dependent resistances encapsulated in Araldite. The limiter is fitted with a flange for mounting on to air-ducts.

6.2 Circuit

The limiter QAX1 operates only with pulsating d.c. voltage of 10 V which is supplied by the controller VARIOPONT RVF5. Two NTC-resistances are used as temperature sensing elements for the inlet air. These resistances are components of a Wheatstone bridge circuit, the output of which, resulting from a limiting cycle, is amplified through a transistorised amplifier. The amplified current flows, via a transformer and rectifier, to the output terminals of the limiter and from there on to the control winding SW1 of the controller RVF5.

Fig. 6.2-1 shows the circuit of the limiter. The N.T.C.-resistances F1 and F2 together form the temperature sensing element in the stem. The stem is fitted into the inlet duct. Potentiometer P1 adjusts the operating value for the limiting action of the inlet air temperature. If the air temperature is higher than the operating value, the bridge circuit produces an output voltage with such a polarity that it is blocked by the transistor T. If the inlet air temperature falls below the operating value, the polarity of the bridge output voltage is reversed. The transistor then receives a control current and becomes conductive. The amplified current flows through the transistor collector. The d.c. portion of the collector current flows through the working resistances R6 and P2, whereas the a.c. portion is conducted via the condensor C to the primary winding of the transformer. The potentiometer P2 is used for the adjustment of the influence of the limiting effect. According to the position of P2 the current through the transformer becomes greater or smaller. The transformer divides the supply and output of the limiter galvanically, to avoid undesirable influences on the controller RVF5. The current on the secondary side of the transformer is rectified in a two way circuit and passes through the resistance R5 to the output terminals 3 and 4.

7. Outdoor temperature compensator (Summer/ Winter shift)

7.1 Construction

The connection head of the compensator serves as the housing for the circuit elements. The connection terminals and the three adjusters are accessible only when the housing cover is removed. Fig. 7.1-1 shows the construction of the compensator QAX2. The potentiometer for adjustment of the set value for outdoor temperature has a setting knob. The two influence potentiometers have screw slots for use when adjusting, the point formed by the sliding contact acts as a scale indicator.

All circuit elements are wired on to a printed circuit board, which also carries the connection terminals. The circuit elements in the housing have no protective covering as the compensator should only be adjusted at the time of commissioning of the plant and is not for continuous adjustment.

The sensing element is encapsulated in Araldite in the end of the stem. The compensator is fitted with a flange for mounting on to the fresh air duct.

7.2 Circuit

The N.T.C. temperature sensing resistance is a part of the Wheatstone bridge circuit. The output of this bridge circuit is fed in to the transistorised amplifier to give the winter and the summer influence. The third transistor is used as a common output amplifier. Its output current passes through a transformer and rectifier to the output terminals of the compensator.

Fig. 7.2-1 shows the basic circuit of the compensator. The N.T.C.-resistance F1 is used as the temperature sensing element. P3 is the potentiometer used for adjusting the set value for the outdoor temperature. F1 and P3 lay in the middle leg of the bridge. The left and right hand legs of the bridge are formed from resistances with fixed values. In the diagonal between the left and the middle legs of the bridge lies the transistor T1, and between the right hand and the middle legs of the bridge lies T2. The potentiometers P1 and P2 are the working resistances for the transistors T1 and T2. The authority for winter is set on P1 and for summer authority on P2.

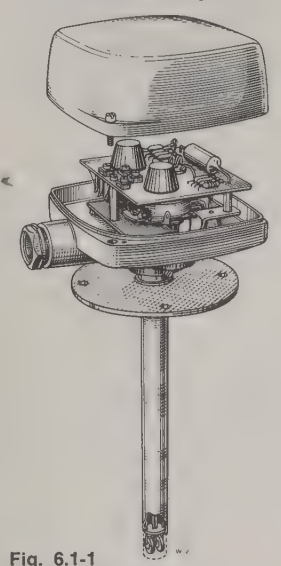


Fig. 6.1-1
Low limiter QAX1

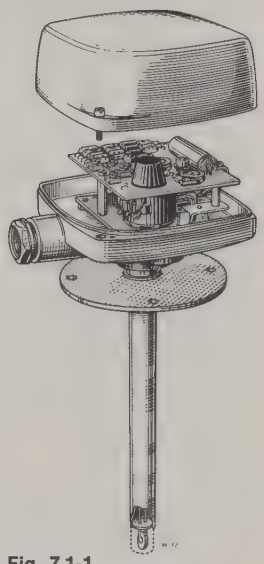


Fig. 7.1-1
Outdoor temperature compensator QAX2

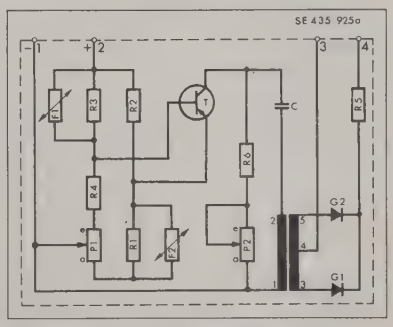


Fig. 6.2-1 Internal circuit of the low limiter QAX1

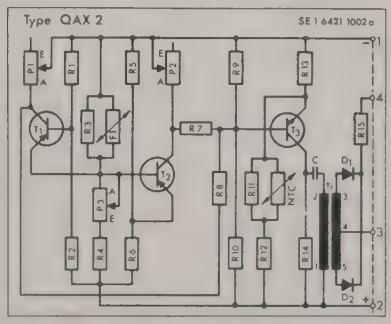


Fig. 7.2-1 Internal circuit of the Outdoor temperature compensator QAX2

8. Technical data

8.1 Controller RVF5

Sensitivity	±1% of setting range for temperature and pressure detectors, ±2% of setting range for humidity and pressure difference detectors
Shortest control step	0,7 ... 1 sec.
Resistance of a control winding	180 ohms
Thermal reset	
Heating time constant	Approx. 90 secs.
Cooling time constant	Approx. 140 secs.
Effective range	Adjustable 0 ... 100% of setting range for temperature and pressure detectors, 0 ... 200% for humidity and pressure difference detectors
Supply voltage	220 V —15 +20%
Mains frequency	45 ... 60 cycles
Power consumption of the controller	7 VA
Permissible contact loading	
Control contacts (terminals 8 and 9)	220 V, max. 1 A~
Signalling contacts (terminals 11 and 12)	220 V, max. 15VA
Permissible ambient temperature	—5 ... +40°C
Net weight of controller	3,1 kg.

8.2 Immersion temperature detector QAE3r

Application range	—30 ... +160°C
Sensing element	Nickel wire
Resistance	100 ohms at 0°C
Mean temperature coefficient of resistance between 0 and 100° C	$6{\cdot}17 \times 10^{-3}$/°C (DIN 43760)
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.3 Cable type temperature detector QAH3r and capillary type temperature detector QAK3r (not for liquids)

Application range	—30 ... +90°C
Sensing element	Nickel wire
Resistance	100 ohms at 0°C
Mean temperature coefficient of resistance between 0 and 100° C	$6{\cdot}17 \times 10^{-3}$/°C (DIN 43760)
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.4 Clamp-on temperature detector QAD3

Application range	0 ... 100°C
Sensing element	Nickel wire 100 ohms at 0°C
Temperature coefficient of resistance between 0 and 100° C	$6{\cdot}17 \times 10^{-3}$/°C (DIN 43760)
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.5 Room temperature detector QAA4 ...

Application range	In dry rooms up to a max. 80°C
Sensing element	Nickel wire
Resistance	100 ohms at 0°C
Mean temperature coefficient resistance between 0 and 100° C	$6{\cdot}17 \times 10^{-3}$/°C (DIN 43760)
Max. permissible resistance of a connecting lead to the controller	3 ohms
Setting range of the built-in setting unit if fitted	5 ... 35°C

8.6 Weather detector QAC3

Sensing element	Nickel wire 100 ohms at 0°C
Mean temperature coefficient of resistance	$6{\cdot}17 \times 10^{-3}$/°C (DIN 43760)
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.7 Immersion temperature detector QAE3pt20

Application range	up to 250°C
Sensing element	platinum wire
Resistance	100 ohms at 0°C
Mean temperature coefficient of resistance between 0 and 100° C	$3{\cdot}85 \times 10^{-3}$/°C
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.8 Air humidity detectors QFB1 and QFC1

Operating range	20 ... 100% relative humidity with temperatures between 10 and 40°C
Sensing element	Lithium-Chloride
Time constant of the QFB1	about 2 mins.
Time constant of the QFC1	about 6 mins.
Electric supply	Via the mains power pack EEV1
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.9 Pressure detectors QBD2

Control range	See also Chapter 3.4
QBD2.1	0 ... 1 kp/cm² (0-14 p.s.i.)
QBD2.5	0 ... 5 kp/cm² (0-73 p.s.i.)
QBD2.20	0 ... 20 kp/cm² (0-280 p.s.i.)
QBD2.6	0 ... 6 atmos. absol. (0-88 p.s.i.a.)
Max. permissible resistance of a connecting lead to the controller	3 ohms

8.10 Pressure difference detectors QCG1

Available for measurement ranges	0 ... 1 mm WS (0 ... 0·039 in.w.g.) 0 ... 2 mm WS (0 ... 0.078 in.w.g.) 0 ... 5 mm WS (0 ... 0.195 in.w.g.) 0 ... 15 mm WS (0 ... 0·585 in.w.g.) 0 ... 40 mm WS (0 ... 1.560 in.w.g.)
Permissible media	Neutral gases and air without aggressive gas components (max. temp. 50°C)
Max. permissible resistance of a connecting lead to the controller	3 ohms

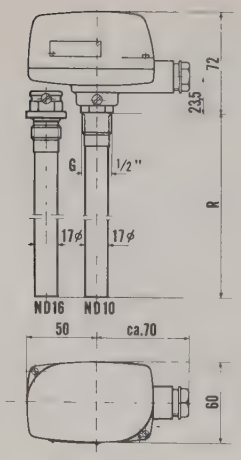
8.11 Low limiter QAX1

Setting range for the operating temperature	9 ... 23°C
Setting range for the influence of the limiting action (scale x 100)	65 ... 300%
supply	Full wave rectified a.c. unfiltered
Supply voltage	10 V ± 0·5 V
Current input	10 mA
Output current for 1°C deviation below the operating temperature	
with influence 100%	approx. 70 µA
with influence 300%	approx. 210 µA

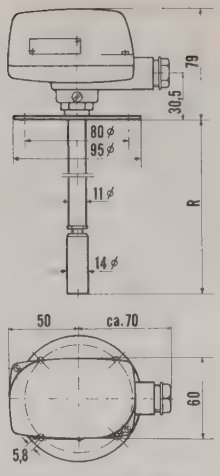
Permissible ambient temperature for the connection head and stem sensing element	—5 . . . +60°C

8.12 Outdoor temperature compensator QAX2

Setting value of the outdoor temperature	0 . . . 30°C
Winter influence	0 . . . 35%
Summer influence	0 . . . 150%
Power supply	Full wave rectified a.c. unfiltered
Supply voltage	10 V ± 0·5 V
Current input	max. 20 mA
Output current terminals 3 and 4	
with winter influence 10% —15° deviation from set value (dead Zone 5°C)	approx. 70 µA
with summer influence 50% and +10°C deviation from set value	approx. 350 µA
Permissible ambient temperature for the connection head and stem sensing element	—30 . . . +40°C

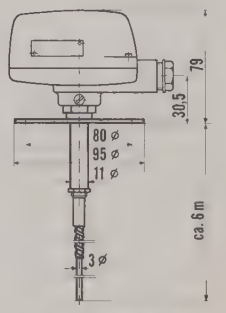


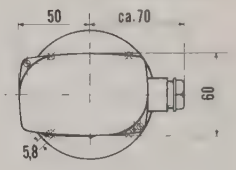
QAE3r . . . with pocket



QAE3r . . . with flange

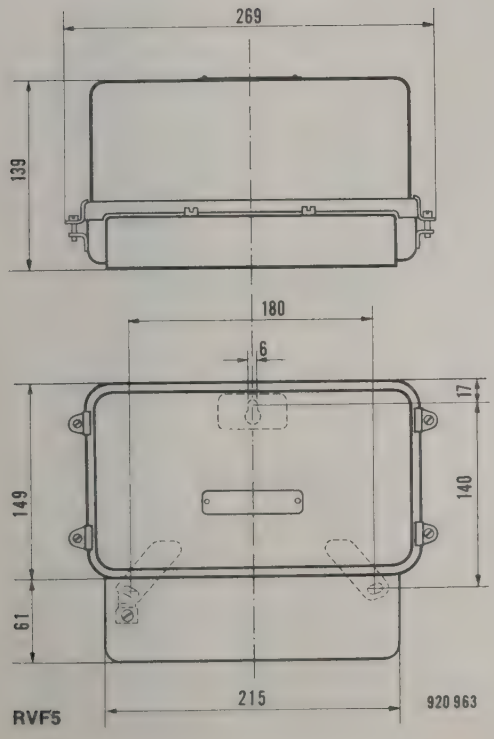
QAH3r



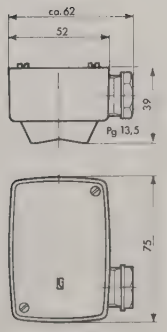


QAK3r . . .

Dimension Drawings



RVF5



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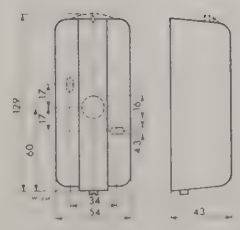

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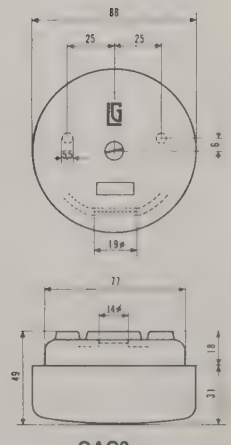

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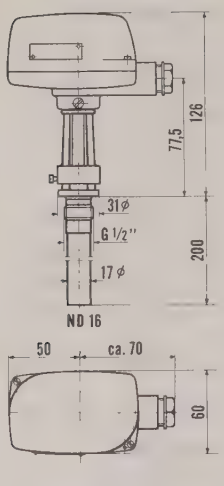
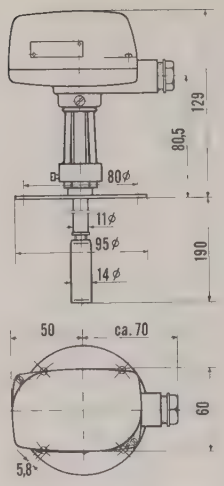
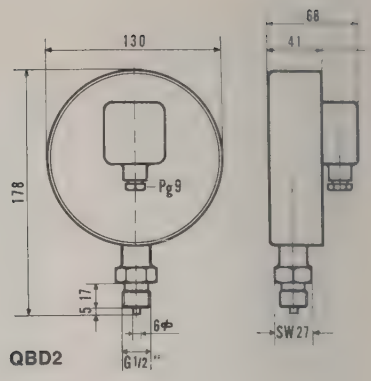


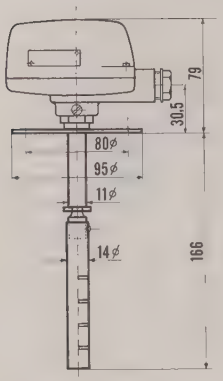
QAE3pt20 with pocket

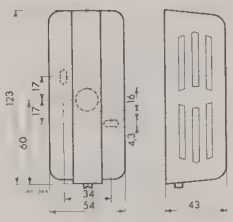


QAE3pt20 with flange



QBD2





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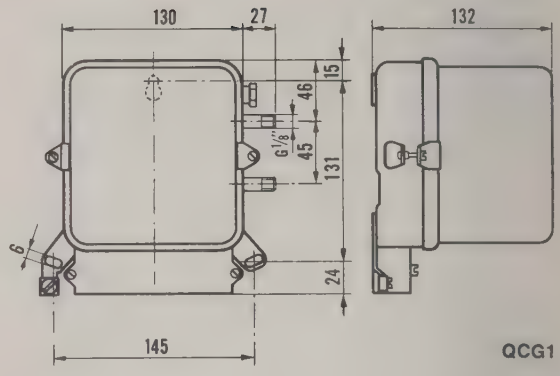

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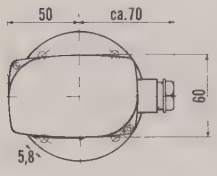

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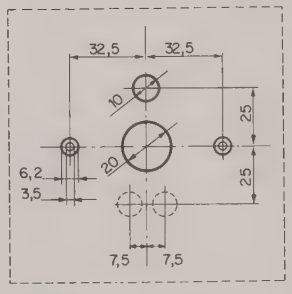
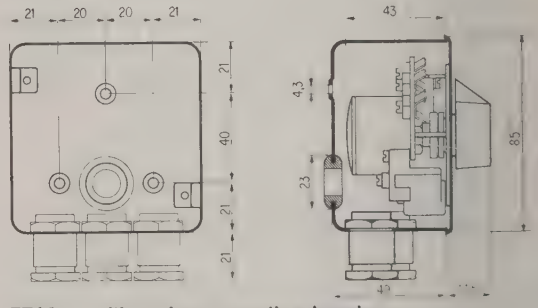
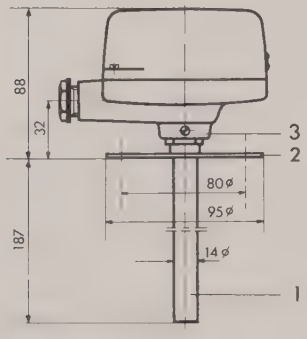
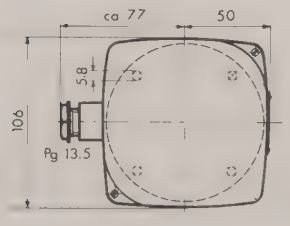


Drilling plan for flush mounting of FZA2...

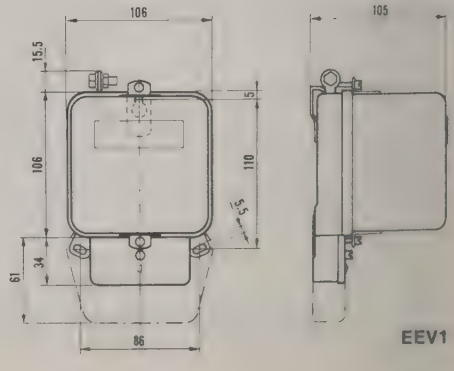


FZA2... with surface mounting housing





QAX1 / QAX2



EEV1

9. Resistance tables

Table 9.1 Temperature detectors with nickel sensing element (100 ohms at 0°C)

°C	Ω	°C	Ω	°C	Ω	°C	Ω	°C	Ω	°C	Ω
		0	100.00								
—30	84.15	1	100.56	31	117.68	61	135.94	91	155.68	142	192.42
—29	84.66	2	101.12	32	118.26	62	136.58	92	156.36	144	193.94
—28	85.17	3	101.68	33	118.84	63	137.22	93	157.04	146	195.48
—27	85.68	4	102.24	34	119.42	64	137.86	94	157.72	148	197.04
—26	86.19	5	102.80	35	120.00	65	138.50	95	158.40	150	198.60
—25	86.70	6	103.36	36	120.60	66	139.14	96	159.06	152	200.20
—24	87.22	7	103.92	37	121.20	67	139.78	97	159.72	154	201.70
—23	87.74	8	104.48	38	121.80	68	140.42	98	160.38	156	203.30
—22	88.26	9	105.04	39	122.40	69	141.06	99	161.04	158	204.80
—21	88.78	10	105.60	40	123.00	70	141.70	100	161.70	160	206.40
—20	89.30	11	106.16	41	123.60	71	142.34	102	163.10		
—19	89.82	12	106.72	42	124.20	72	142.98	104	164.50		
—18	90.34	13	107.28	43	124.80	73	143.62	106	165.92		
—17	90.86	14	107.84	44	125.40	74	144.26	108	167.36		
—16	91.38	15	108.40	45	126.00	75	144.90	110	168.80		
—15	91.90	16	108.98	46	126.62	76	145.56	112	170.24		
—14	92.44	17	109.56	47	127.24	77	146.22	114	171.68		
—13	92.98	18	110.14	48	127.86	78	146.88	116	173.12		
—12	93.52	19	110.72	49	128.48	79	147.54	118	174.56		
—11	94.06	20	111.30	50	129.10	80	148.20	120	176.00		
—10	94.60	21	111.88	51	129.72	81	148.88	122	177.48		
— 9	95.14	22	112.46	52	130.34	82	149.56	124	178.96		
— 8	95.68	23	113.04	53	130.96	83	150.24	126	180.44		
— 7	96.22	24	113.62	54	131.58	84	150.92	128	181.92		
— 6	96.78	25	114.20	55	132.20	85	151.60	130	183.40		
— 5	97.30	26	114.78	56	132.82	86	152.28	132	184.89		
— 4	97.84	27	115.36	57	133.44	87	152.96	134	186.36		
— 3	98.38	28	115.94	58	134.06	88	153.64	136	187.86		
— 2	98.92	29	116.52	59	134.68	89	154.32	138	189.38		
— 1	99.46	30	117.10	60	135.30	90	155.00	140	190.90		

Table 9.2 Temperature detectors with platinum sensing element (100 ohms at 0°C)

°C	Ω	°C	Ω	°C	Ω	°C	Ω	°C	Ω	°C	Ω
0	100.00										
1	100.39	31	112.06	61	123.62	91	135.08	205	177.59	355	231.07
2	100.78	32	112.44	62	124.00	92	135.46	210	179.42	360	232.80
3	101.17	33	112.83	63	124.39	93	135.84	215	181.24	365	234.53
4	101.56	34	113.22	64	124.77	94	136.22	220	183.06	370	236.26
5	101.95	35	113.60	65	125.15	95	136.60	225	184.88	375	237.99
6	102.34	36	113.99	66	125.54	96	136.98	230	186.69	380	239.72
7	102.73	37	114.38	67	125.92	97	137.36	235	188.50	385	241.44
8	103.12	38	114.76	68	126.30	98	137.74	240	190.31	390	243.16
9	103.51	39	115.15	69	126.96	99	138.12	245	192.12	395	244.88
10	103.90	40	115.54	70	127.07	100	138.50	250	193.93	400	246.60
11	104.29	41	115.92	71	127.45	105	140.39	255	195.73	405	248.32
12	104.68	42	116.31	72	127.84	110	142.28	260	197.53	410	250.04
13	105.07	43	116.70	73	128.22	115	144.17	265	199.32	415	251.75
14	105.46	44	117.08	74	128.60	120	146.05	270	201.11	420	253.46
15	105.85	45	117.47	75	128.99	125	147.93	275	202.90	425	255.17
16	106.24	46	117.86	76	129.37	130	149.80	280	204.68	430	256.88
17	106.63	47	118.24	77	129.75	135	151.67	285	206.46	435	258.58
18	107.02	48	118.63	78	130.13	140	153.54	290	208.24	440	260.28
19	107.41	49	119.01	79	130.51	145	155.41	295	210.02	445	261.98
20	107.79	50	119.40	80	130.89	150	157.28	300	211.79	450	263.67
21	108.18	51	119.78	81	131.28	155	159.14	305	213.56	455	265.36
22	108.57	52	120.17	82	131.66	160	161.00	310	215.32	460	267.05
23	108.96	53	120.55	83	132.04	165	162.86	315	217.08	465	268.74
24	109.35	54	120.93	84	132.42	170	164.71	320	218.84	470	270.42
25	109.74	55	121.32	85	132.80	175	166.56	325	220.60	475	272.10
26	110.13	56	121.70	86	133.18	180	168.40	330	222.35	480	273.77
27	110.52	57	122.09	87	133.56	185	170.24	335	224.10	485	275.44
28	110.90	58	122.47	88	133.94	190	172.08	340	225.85	490	277.10
29	111.29	59	122.85	89	134.32	195	173.92	345	227.59	495	278.75
30	111.67	60	123.24	90	134.70	200	175.76	350	229.33	500	280.39

10. Installation

The controller should be mounted on a vertical surface with the terminals below. It must not be subjected to any appreciable vibration. The permissible ambient temperature is —5 . . . +40°C.
Local regulations must be complied with when wiring. The terminals of the RVF5 are of the screw type into which the stripped ends of the wires are inserted without being looped. The connections are arranged so that looping from one terminal to another is avoided as far as possible. The leads to the detectors and setting units operate at low voltage and can therefore be made in ordinary insulated wire. Special care must be devoted to the terminal connections of these leads, for any resistance will affect the calibration of the controller. If possible the leads in question should be connected between controller, detector and setting unit in one unbroken length. The use of plug connections for the connection leads is to be avoided. The detector and the setting unit must each be wired with three conductors of equal cross-section, and the resistance per lead must not exceed 3 ohms; failing this there will be a loss of sensitivity. It is not necessary to include the lead resistance for calibration purposes because the three-wire circuit provides its own compensation. The leads carry d.c. only and are unaffected by a.c. pick-up. When the setting unit is fitted with signal lamps for indication of the control impulses, it is to be noted that the wires to the lamps carry mains voltage, whereas the wires running to terminals 1, 2 and 3 of the setting unit operate at low voltage.
In the case of a control motor with feedback potentiometer it must also be noted that the feedback potentiometer operates on low voltage, whereas the control lines are at mains voltage.

Circuit examples

Temperature control
1 Temperature control with one detector, PI control
2 Temperature control with a platinum sensing element (of other manufacture), PI control
3 Temperature control with one detector, P control
4 Temperature control with a platinum sensing element (of other manufacture), P control
5 Anticipatory room temperature control for ventilating plant P+PI control
6 Anticipatory room temperature control with low limiting of the inlet air temperature, P+PI control
7 Anticipatory room temperature control with low limiting of the inlet air temperature and outdoor temperature compensation, P+PI control with compensation
8 Outdoor temperature dependent control with small slope or large slope, PI control with compensation
9 Calorifier or flow temperature control, outdoor compensation and constant temperature PI control with compensation
10 Temperature difference control, PI control

Humidity control
11 Control of absolute humidity, PI control
12 Control of relative humidity, PI control
13 Anticipatory room humidity control, P+PI control
14 Control of relative humidity, P control

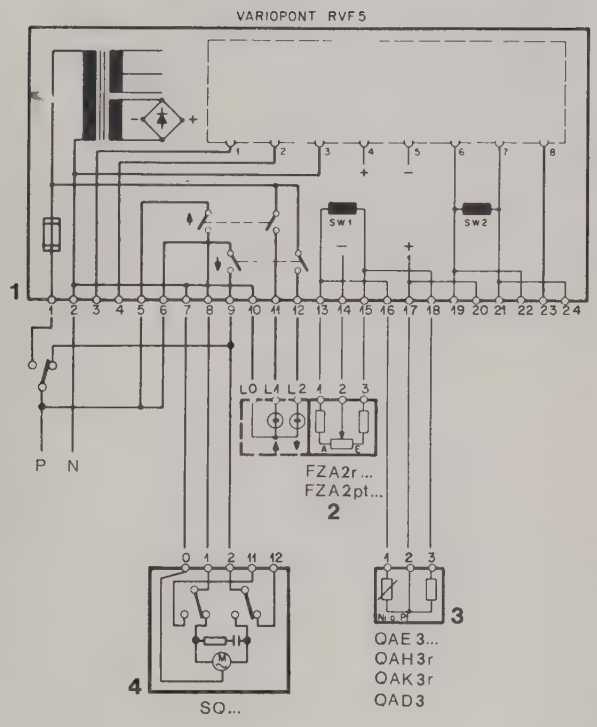
Pressure control
15 Pressure control, PI control
16 Pressure control, P control
17 Pressure difference control, PI control
18 Pressure difference control, P control
19 Pressure difference control with two detectors type QBD . . . , PI control

VARIOPONT Control System

Diagram **1**

Temperature control with one detector

PI control



List of control equipment
1. Controller Variopont RVF5
2. Setting unit FZA2r for nickel sensing element, FZA2pt for platinum sensing element
3. Temperature detector 100 ohms at 0° C with nickel or platinum sensing element
4. Control motor of the type SQ . . . with a running time of approx. 2 minutes

Application
This circuit is applicable to all control duties for which the PI type of controller is suitable, e.g. temperature control of inlet air in ventilating plant, flow temperature control in central heating systems, temperature control of calorifiers, etc. This circuit is not suitable for the control of room temperature with only one detector. The diagrams 3,5 . . . 7 are recommended for room temperature control. It should be understood that this diagram merely serves as a basis for the connections between the control apparatus of the Variopont system.

Description of the control function
This diagram shows the simplest form of circuit for temperature control with the Variopont RVF5 controller. The setting unit and the temperature detector together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The RVF5 Variopont controller is of the PI type, being provided with a thermal reset circuit. This serves to stabilise the control action and must be adjusted to suit the control characteristics of the complete installation. The value to which the setting unit is set is termed the «set value Xd1». The actual value is the value measured by the detector. The desired value is the value which the controller should establish on the basis of the set value Xd1 and the momentary proportional range. Under static conditions the desired value is the same as the set value Xd1. When the actual value deviates from the desired value, the controller delivers control impulses to the control motor, the effect being to diminish the deviation. Each time the controller operates it causes the thermal resetting circuit to establish a proportional range which temporarily displaces the desired value in the direction of the actual value. The result of this displacement is that the control action is interrupted before the actual value has reached the set value Xd1. After this, the proportional range again diminishes with the result that the desired value once more nears the set value Xd1. If, now, the actual value measured by the detector has not yet reached the set value Xd1, the controller delivers a further control command to the control motor. The sequence of events described is then repeated with control commands of steadily diminishing duration, until ultimately the actual value coincides with the set value Xd1.
The advantage of PI control compared with simple proportional control is that there is no continued control deviation; a proportional range only appears temporarily and ultimately diminishes to zero.

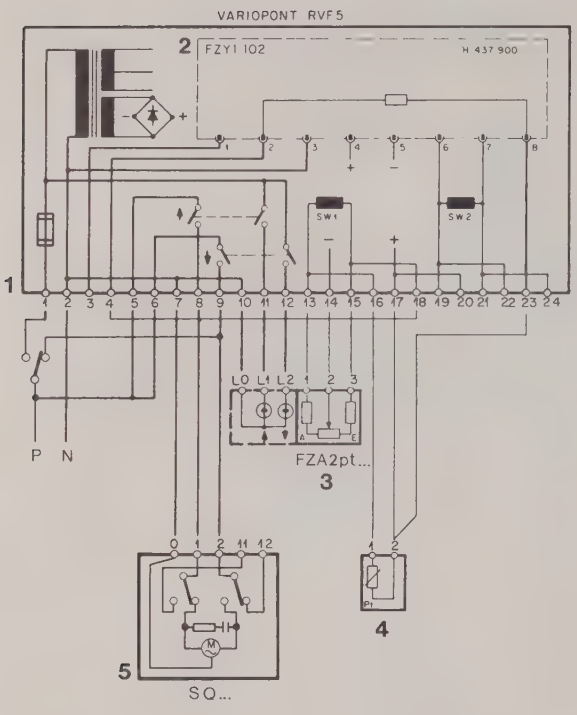
Setting instructions
The knob RF in the controller allows for the adjustment of the thermal reset between 0 and 100%. The reset must be set high enough to give stability of control, i.e. to prevent «hunting». Hunting consists of a continuous fluctuation of control, the desired value being exceeded at each cycle. Too low a setting of the thermal reset tends to produce hunting, while too high a setting delays the approach to the set value. The action of the controller should be observed and the setting adjusted accordingly.

VARIOPONT Control System

Diagram **2**

Temperature control with a platinum sensing element (of other manufacture)

PI control



List of control equipment
1. Controller Variopont RVF5
2. Plug-in unit FZY1.102 (inserted in controller, not adjustable)
3. Setting unit FZA2pt . . .
4. Temperature detector with platinum sensing element 100 ohms at 0°C (Degussa)
5. Control motor of the typeSQ . . .
   Running time approx. 2 minutes

Application
This circuit is intended for control duties involving high temperatures.
The diagram serves only as a basis for the connection of the control apparatus of the VARIOPONT system.

Description of the control function
This circuit is used for Platinum· temperature sensing elements, which are not provided with any bridge components except for the sensing element itself, e.g. the «Degussa» sensing element (100 ohms at 0°C). The remainder of the bridge circuit, which in the case of our own temperature detectors is fitted in the connection head or sensing element housing, is fitted in the plug-in unit for these special detectors. This circuit is similar in principle to that shown in Diagram 1. The setting unit together with the temperature sensing element and the bridge resistance in the plug-in unit, form a bridge circuit in the cross-section of which lies the control winding SW1 of the controller. In other respects the function description is as that for Diagram 1.

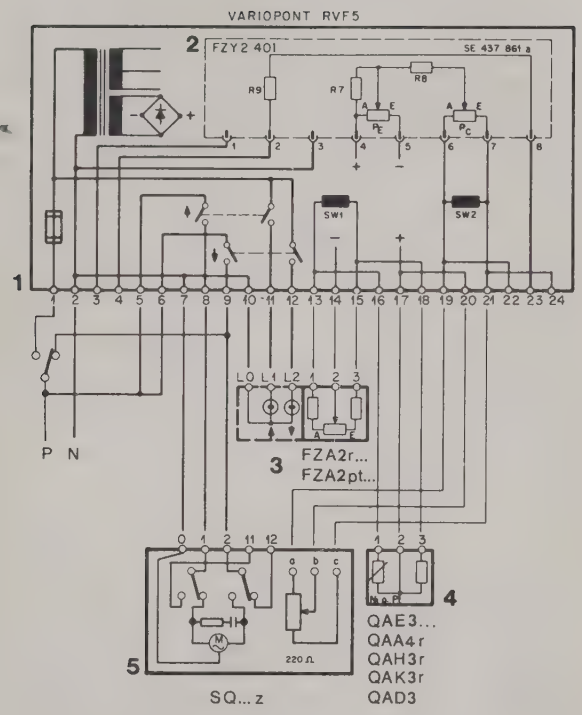
Setting instructions
Besides the desired value, in this circuit, only the thermal reset RF has to be set on the controller. This latter serves for the stabilisation of the control action and must be adjusted to suit the characteristics of the installation.

VARIOPONT Control System

Diagram **3**

Temperature control with one detector

P control



List of control equipment
1. Controller RVF5
2. Plug-in unit FZY2.401 (inserted in controller)
   Scale 1: Proportional band, 0 . . . 100%
   Scale 2: Corr., Position of the P-Band compared with the desired value
3. Setting unit FZA2r . . . for nickel sensing element, or FZA2pt . . . for platinum sensing element
4. Temperature detector 100 ohms at 0°C with nickel or platinum sensing element
5. Control motor of the type SQ . . . z with feedback potentiometer 220 ohms. Running time approx. 2 minutes

Application
Proportional control is used for applications involving slow changes, for which the PI type of control is not suitable. These applications include process baths, room temperature control, control of exhaust air temperature, etc.
In the case of room temperature control in ventilating plant it is better to use an anticipatory control system as shown in Diagrams 5 . . . 7, rather than simple P-control.
It should be understood that this diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
This diagram deals with the simplest possible circuit for proportional control, using one temperature detector. The setting unit and the temperature detector together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The feedback potentiometer in the control motor and the potentiometer PC in the plug-in unit combine to form a second bridge circuit, in the cross-section of which lies control winding SW2 of the controller. Potentiometer PE in the plug-in unit serves for adjustment of the proportional range, while the potentiometer PC marked «Corr» is used for the displacement of the proportional range.
The value to which the setting unit is set is termed the «set value Xd1». The actual value is the value of controlled condition measured by the detector. As the proportional controller works in a load dependent manner, the actual value and the set value Xd1 correspond only to the load condition, which is selected through the setting knob «Corr.» In all other load conditions a deviation from the set value arises. This form of deviation is designated as a P-Deviation (△x). Its value is dependent upon the momentary load condition, the adjusted P-Band (Xp) and the plant gain of the installation being controlled.
With a deviation of the actual value from the desired value, the controller gives a control command to the control motor, the effect of which is to diminish the deviation. At the same time the second bridge circuit receives a reset signal proportional to the movement of the control motor, which also works contrary to control deviation. Thus the control command is interrupted before the actual value reaches the set value. As the reset signal, which is determined by the control motor position, and the value of the P-range (reset value) remains the same there results a continued control deviation (P-Deviation △x).

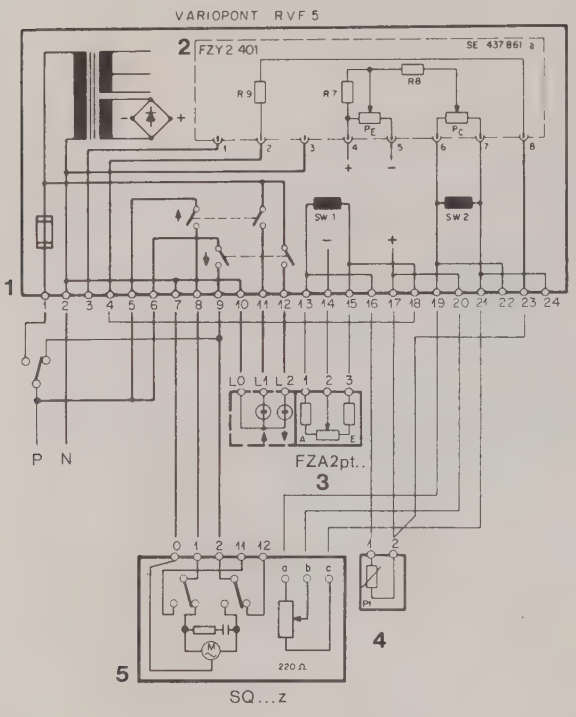
Setting instructions
The P-Band, which can be controlled between 0 . . . 100% by adjustment of the plug-in unit, must be set high enough to give stability of control, i.e. to prevent «hunting». Hunting consists of a continuous on/off fluctuation of control, the desired value being exceeded at each cycle. Too low a setting of the P-Band tends to produce hunting, while too high a setting causes an excessive deviation from the set value Xd1. The action of the controller should be observed and the setting adjusted accordingly. If it is found, when stable conditions have been obtained, that although steady control is obtained there is an undesirable P-Deviation, this may be corrected by appropriate adjustment of the setting knob «Corr.». Knob RF in the controller should be set to 0 for proportional control.

VARIOPONT Control System

Diagram **4**

Temperature control with one platinum sensing element (of other manufacture)

P control



List of control equipment
1. Controller Variopont RVF5
2. Plug-in unit FZY2.401 (inserted into the controller)
   Scale 1 : Proportional-Band 0 . . . 100%
   Scale 2 : Corr., Position of the P-Band compared with the desired value
3. Setting unit FZA2pt . . .
4. Temperature detector with platinum sensing element 100 ohms/0° C
5. Control motor type SQ . . . z, with built-in feedback potentiometer 220 ohms. Running time approx. 2 minutes

Application
Proportional control for high temperatures, for which a PI controller will not provide the necessary stability. This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
This circuit is for use with a Pt 100 ohms/0° C temperature sensing element which is not equipped with any further bridge components — e.g. the «Degussa» sensing elements. In the case of our temperature detectors, the bridge resistance is mounted either in the connection head or in the sensing element housing. Resistance R9 in the plug-in unit is connected in place of the resistance which is absent from the temperature detector. It should, however, be noted that this circuit is not suitable for use with temperature sensing elements of the nickel type. The circuit is similar in principle to Diagram 3.
The setting unit, together with the temperature sensing element and the bridge resistance R9 in the plug-in unit, together form a bridge circuit in the cross-connection of which lies the control winding SW1 of the controller. The feedback potentiometer in the actuator motor and potentiometer PC in the plug-in unit combine to form a second bridge circuit, in the cross-connection of which lies the control winding SW2 of the controller. The proportional range is set by means of the potentiometer PE in the plug-in unit, while potentiometer PC (marked «Corr») serves for the displacement of the proportional range. In other respects this circuit agrees in principle with the description given for Diagram 3.

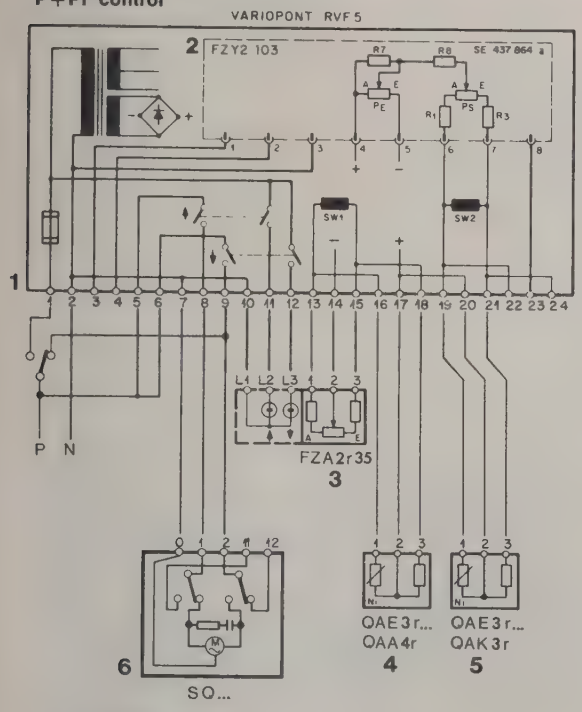
Setting instructions
The setting unit is used for the adjustment of the set value Xd1. The proportional range may be adjusted (from 0 . . . 100%) by means of the left-hand potentiometer in the plug-in unit. If the controlled value (actual value) deviates from the set value Xd1 (setting unit), a correction may be made with the setting knob «Corr.». The setting knob RF in the controller should be set to 0 for proportional control.

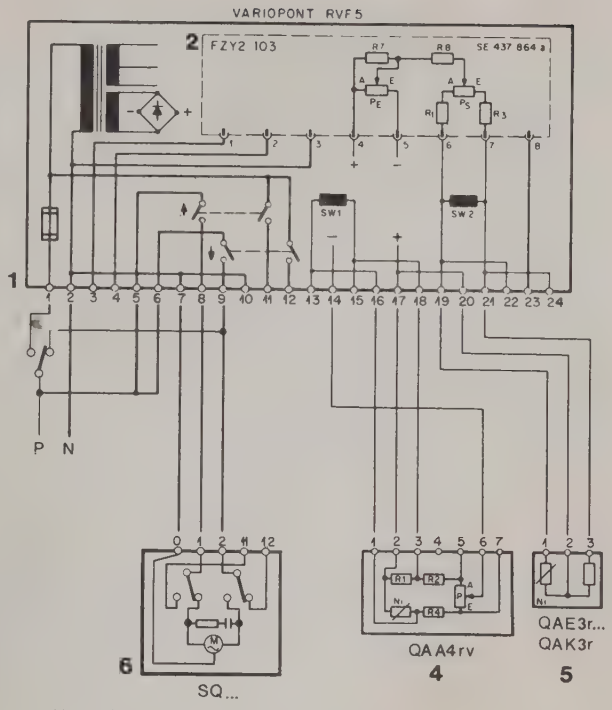
VARIOPONT Control System

Diagram **5**

Anticipatory room temperature control for ventilating plant

P+PI control





List of control equipment
1. Controller RVF5
2. Plug-in unit FZY2.103 (inserted in the controller)
   Scale 1 : Influence of the inlet air temperature detector 5
   0 . . . 40%
   Scale 2 : Setting range for the inlet air temperature detector 5
   10 . . . 60°C
3. Setting unit FZA2r35
   Scale : 5 . . . 35° C
4. Exhaust air temperature detector QAE3r . . . with flange, or room temperature detector QAA4r
5. Inlet air temperature detector QAE3r . . with flange, or capillary type temperature detector QAK3r . . .
6. Control motor of type SQ . . .
   Running time approx. 2 minutes

Application
Control of ventilating and airconditioning plant
This diagram serves only as a guide for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
Temperature detector 4 measures the room temperature, and takes the form either of a room temperature detector mounted in the room or of an immersion detector mounted in the exhaust air duct. Temperature detector 5 measures the inlet air temperature. The setting unit and temperature detector 4 together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The inlet air temperature detector 5 together with the resistances R1 and R3 and potentiometer PS in the plug-in unit are combined to form a second bridge circuit, in the cross-connection of which lies the control winding SW2 of the controller. The potentiometer PS is used for the adjustment of the inlet air temperature Xd1.
The potentiometer PE is used for the adjustment of the authority setting of the detector 5.
«Anticipatory control» is here understood as signifying that the controller regulates the inlet air temperature in relation to the room temperature. By a deviation of the room temperature from the set value Xd1 the desired value of the inlet air temperature for detector 5 also deviates from its set value Xd2, but in an opposite direction. The relationship between these two deviations depends upon the «influence» setting. With an influence setting of 0 the inlet air temperature detector 5 is ineffective, that is the controller operates with detector 4 only. If, for example, the influence setting were 20% the value for the inlet air temperature detector 5 would alter five times as much as the value for the room temperature detector 4. Thus if the room temperature rises 1°C above the value of the set point Xd1, the desired value of the inlet air temperature detector 5 will be lowered 5°C below the value of set point Xd2, assuming an influence of 20%.

Alternative:
Set point setting on detector (4)
(Pos. 3, setting unit FZA . . . not required)

In view of the fact that the controller corrects deviations of room temperature by a proportional adjustment of the inlet air temperature, the effect on the room temperature is similar to that of a proportional controller. The thermal reset causes the control exercises on the inlet air temperature to be of the PI type. Disturbances in the inlet air temperature are thus corrected before they can influence the room temperature. This form of control is known as «anticipatory» control and has the advantage over the simple proportional control system shown in Diagram 3, in that the inlet air temperature is adjusted proportionally to the change of room temperature. The effect of providing pure proportional control would merely be to adjust the control motor proportionally to the change of room temperature.

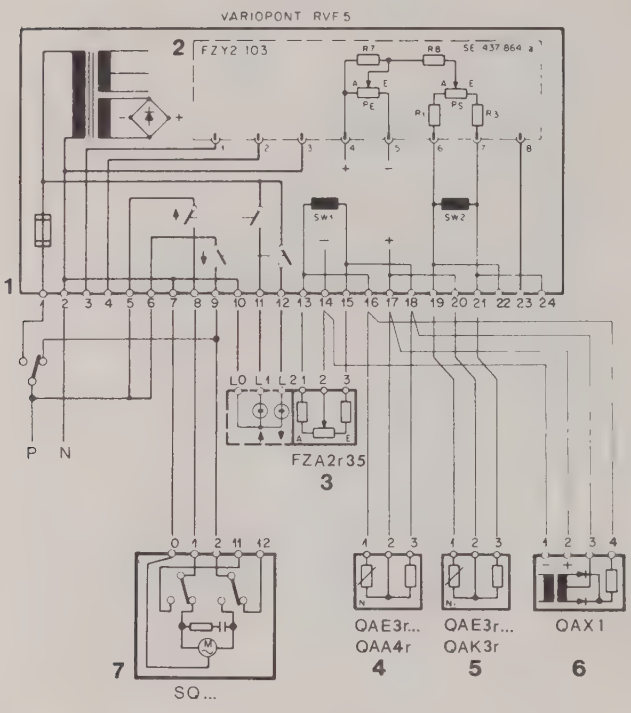
Setting instructions
The desired room temperature is selected on the setting unit. The temperature setting for the inlet air is made on the plug-in unit in the controller to a value required under normal conditions to maintain the desired room temperature. This setting for the inlet air temperature depends on the nature of the ventilating plant, on any background heating that may be present in the room, on the ammount of heat gain developed in the room in other ways, and on the outdoor temperature (assuming that weather sensitive background heating is not provided). If background heating is present and the controlled plant is used only for ventilating the room, the inlet air temperature setting may be made approximately the same as that of the desired room temperature. If, on the other hand, the controlled ventilating plant is also used for heating the room, then it is necessary to set the inlet air temperature to a value exceeding the desired room temperature.
Similarly, the influence of the inlet air temperature detector 5 is set by means of the plug-in unit in the controller. Here again, the required value depends on the nature of the ventilating plant. The lower the influence setting, the greater must be the change in the inlet air temperature to effect a correction of the room temperature, i.e. a disturbance of the room temperature is corrected as rapidly as possible. A larger influence setting gives a more stable form of control of the room temperature, but there will be larger uncorrected variations arising out of the proportional nature of the control.
Generally, experience has shown that the influence setting should be in the order of 15 . . . 20%, allowances being made of this adjustment for any special factors.
The thermal reset RF in the controller should be adjusted so that the inlet air temperature is controlled without any evidence of hunting.

VARIOPONT Control System

Diagram **6**

Anticipatory room temperature control with low limiting of the inlet air temperature

P + PI control



List of control equipment

1. Controller RVF5
2. Plug-in unit FZY2.103 (inserted in controller)
   Scale 1 : Influence of the inlet air temperature detector 5 0 . . . 40%
   Scale 2 : Range of adjustment of the inlet air temperature detector 5 10 . . . 60 °C
3. Setting unit FZA2r35
   Scale : 5 . . . 35 °C
4. Room temperature detector QAA4r or exhaust air temperature detector QAE3r . . .
5. Inlet air temperature detector: Immersion detector QAE3r . . . or capillary type detector QAK3r
6. Low limiter for the inlet air temperature QAX1
7. Control motor for the valve, air damper or step switch, type SQ . . .

Description of the control function

Temperature detector 4 measure the room temperature, and takes the form either of a room temperature detector mounted in the room or of an immersion temperature detector mounted in the exhaust air duct. Temperature detector 5 measures the inlet air temperature. The setting unit and temperature detector 4 together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The inlet air temperature detector 5 together with the resistances R1 and R3 and potentiometer PS in the plug-in unit, are combined to form a second bridge circuit, in the cross-section of which lies the control winding SW2 of the controller. The potentiometer PS is used for the adjustment of the inlet air temperature Xd1. The potentiometer PE is used for the adjustment of the influence setting of the detector 5.

«Anticipatory Control» is here understood as signifying that the controller regulates the inlet air temperature in relation to the room temperature. By a deviation of the room temperature from the set value Xd1, the desired value of the inlet air temperature for detector 5 also deviates from its set value Xd2, but in the opposite direction. The relation-ship between these two deviations depends upon the «influence» setting. With an influence setting of 0 the inlet air temperature detector is ineffective, that is, the controller operates with the detector 4. If, for example, the influence setting were 20%, the value for the inlet air temperature detector 5 would alter five times as much as the value of the room temperature detector 4. Thus, if the room temperature rises 1 °C above the value of the set point Xd1, the desired value for the inlet air temperature detector 5 will be lowered 5 °C below the value of set point Xd2, assuming an influence of 20%.

In view of the fact that the controller corrects deviations of room temperature by a proportional adjustment of the inlet air temperature, the effect on the room temperature is similar to that of a proportional controller. The thermal reset causes the control exercised on the inlet air temperature to be of the PI type. Disturbances in the inlet air temperature are thus corrected before they can have any influence on the room temperature. This form of control is known as «Anticipatory Control» and has the advantage over the simple proportional control system shown in Diagram 3, in that the inlet air temperature is adjusted proportionally to the change of room temperature. The effect of providing pure proportional control would merely be to adjust the control motor proportionally to the change in room temperature.

Should there be a large rise of the room temperature due to heat gain caused through an assembly of people, machines, lighting, solar radiation etc., the controller would tend to reduce strongly the inlet air temperature. Without a limiting factor, this control action could cause such a reduction of the inlet air temperature that draughts are felt in the room and, in extreme cases, the frost thermostat would operate and switch off the fans. To avoid such occurences, the inlet air temperature is limited in the lower ranges by means of the Low Limiter QAX1. When in operation, the low limiter works against the effect of the room temperature detector, thus preventing any further reduction of the inlet air temperature.

Setting instructions

The desired room temperature is selected on the setting unit. The temperature setting for the inlet air is made on the plug-in unit in the controller to a value required, under normal conditions, to maintain the desired room temperature. This setting for the inlet air temperature depends on the nature of the ventilating plant, on any background heating that may be present in the room, on the amount of heat gain developed in the room in other ways, and on the outdoor temperature (assuming that weather sensitive background heating is not provided). If background heating is present and the controlled plant is used only for ventilating the room, the inlet air temperature setting may be made approximately the same as that of the desired room temperature. If on the other hand, the controlled ventilating plant is also used for heating the room, then it is necessary to set the inlet air temperature to a value exceeding the desired room temperature.

Similarly, the influence of the inlet air temperature detector 5 is set by means of the plug-in unit in the controller. Here again, the required value depends on the nature of the ventilating plant. The lower the influence setting, the greater must be the change in the inlet air temperature to effect a correction of the room temperature, i.e. a disturbance of the room temperature is corrected as rapidly as possible. A larger influence setting gives a more stable form of control of the room temperature, but there will be a possibility that constant control deviations become larger due to the proportional control. Generally, experience has shown that the influence setting should be in the order of 15 . . . 20%, allowances being made to this adjustment for any special factors.

The thermal reset RF in the controller should be adjusted that the inlet air temperature is controlled without any evidence of hunting. The low limiter has two setting knobs, for operating temperature (9 . . . 23 ° C) and the limiting influence (65 . . . 300%).

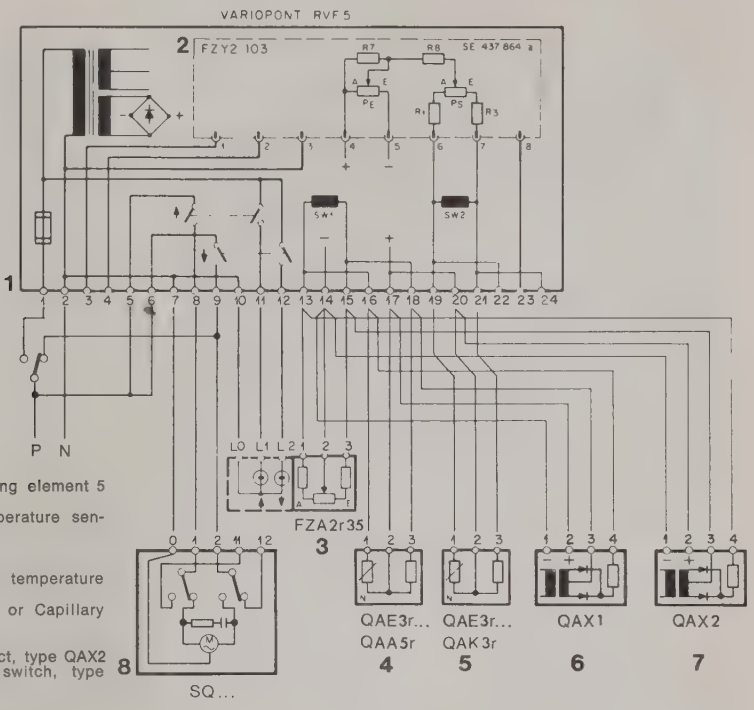
The ideal set point for the operating temperature is dependent upon the actual nature of the ventilating plant. The normal set point experienced lies between 15 . . . 18 ° C. With a high input air velocity, i.e. through grills, the operating temperature may not be chosen at too low a value. With installations where perforated ceilings are in use the operating temperature may be set at a lower value, in most cases. In all cases, however, it must be ensured that the low limit temperature is low enough, on one hand, to allow for heat gain in the room to be countered without, on the other hand, allowing draughts to appear in the room. An influence setting of 100% on the low limiter will, for most ventilating installations, ensure good results. It is with the influence setting that the continuous effect of the limiter is established. The lower the influence setting, the limiter allows the inlet air temperature to fall further below the operating temperature; the higher the influence setting this becomes less the case. With an increase in the influence setting there is also an increase of the controller sensitivity, i.e. the controller responds to lower value alterations of the inlet air temperature during a limiting operation when the influence is at a lower setting. The controller sensitivity may not be increased to any great extent, as the control function would become unstable.

VARIOPONT Control System

Diagram **7**

Anticipatory room temperature control with low limiting of the inlet air temperature and outdoor temperature compensation

P+PI control with compensation



List of control equipment

1. Controller RVF5
2. Plug-in unit FZY2.103 (inserted in controller)
   Scale 1 : Influence of the inlet air temperature sensing element 5 0 . . . 40%
   Scale 2 : Range of adjustment of the inlet air temperature sensing element 5 10 . . . 60° C
3. Setting unit FZA2r35
   Scale : 5 . . . 35° C
4. Room temperature detector QAA4r or exhaust air temperature detector QAE3r . . .
5. Inlet air temperature detector: Stem type QAE3r . . . or Capillary type QAK3r
6. Low limiter for the inlet air temperature QAX1
7. Outdoor temperature compensator in the fresh air duct, type QAX2
8. Control motor for the valve, air damper or step switch, type SQ . . .

Description of the control function

Temperature detector 4 serves for the measurement of the room temperature, and takes the form either of a room temperature detector mounted in the room or of an immersion temperature detector mounted in the exhaust air duct. Temperature detector 5 measures the inlet air temperature. This circuit is similar in principle and function to that described in Diagram 6 but with the addition of the outdoor temperature compensator which effects the following operation.

In winter operation, the outdoor temperature compensator increases the inlet air temperature with a fall in outdoor temperature, thus compensating for the resultant heat losses of the ventilated room before they can influence the actual room temperature. The room temperature thus remains constant independent of the outdoor temperature. By increasing the winter influence the outdoor temperature compensator also allows an increase of the room temperature when, by falling outdoor temperature, the cold radiation from walls and windows tends to balance out a rising room air temperature.

In summer operation the effective direction of the compensator is reversed. The inlet air temperature is increased by rising outdoor temperature, so that the desired increase in room temperature in relation to outdoor temperature is achieved. In this manner it is possible to avoid large differences between indoor and outdoor temperatures and achieve at the same time relief of the cooling load.

Setting instructions

The desired room temperature is selected on the setting unit. The temperature setting for the inlet air is made on the plug-in unit in the controller to a value required, under normal conditions, to maintain the desired room temperature. This setting for the inlet air temperature depends on the nature of the ventilating plant, on any background heating that may be present in the room, on the amount of heat gain developed in the room in other ways, and on the outdoor temperature (assuming that weather sensitive background heating is not provided). If background heating is present and the controlled plant is used only for ventilating the room, the inlet air temperature setting may be made approximately the same as that for the desired room temperature. If on the other hand, the controlled ventilating plant is also used for heating the room, then it is necessary to set the inlet air temperature to a value exceeding the desired room temperature.

Similarly, the influence of the inlet air temperature detector 5 is set by means of the plug-in unit in the controller. Here again, the required value depends on the nature of the ventilating plant. The lower the influence setting, the greater must be the change in the inlet air temperature to effect a correction of the room temperature, i.e. a disturbance of the room temperature is corrected as rapidly as possible. A larger influence setting gives a more stable form of control of the room temperature, but there will be a possibility that constant control deviations become larger due to the proportional control. Generally, experience has shown that the influence setting should be in the order of 15 . . . 20%, allowances being made to this adjustment for any special factors.

The thermal reset RF in the controller should be adjusted so that the inlet air temperature is controlled without any evidence of hunting.

The low limiter has two setting knobs, for operating temperature (9 . . . 23° C) and the limiting influence (65 . . . 300%).

The ideal set point for the operating temperature is dependent upon the actual nature of the ventilating plant. The normal set point experienced lies between 15 . . . 18° C. With a high input air velocity, i.e. through grills, the operating temperature may not be chosen at too low a value. With installations where perforated ceilings are used the operating temperature may be set to a low value in most cases. In all cases, however, it must be ensured that the low limit temperature is low enough, on one hand, to allow for heat gain in the room to be countered without, on the other hand, allowing draughts to appear in the room. An influence setting of 100% on the low limiter will, for most ventilating installations, ensure good results. It is with the influence setting that the continuous effect of the limiter is established. The lower the influence setting, the limiter allows the inlet air temperature to fall further below the operating temperature; the higher the influence setting this becomes less the case. With an increase of the influence setting there is also an increase in the controller sensitivity, i.e. the controller responds to alterations of the inlet air temperature of a lower value during a limiting operation than when the influence is at a lower setting. The controller sensitivity may not be increased to any great extent, as the control function would become unstable.

The influence values of the outdoor temperature compensator are referred to the main detector (room temperature detector). When the outdoor temperature falls below the set operating temperature of the compensator the winter influence is effective; with temperatures above the set value then the summer influence becomes operative.

Normal setting values:

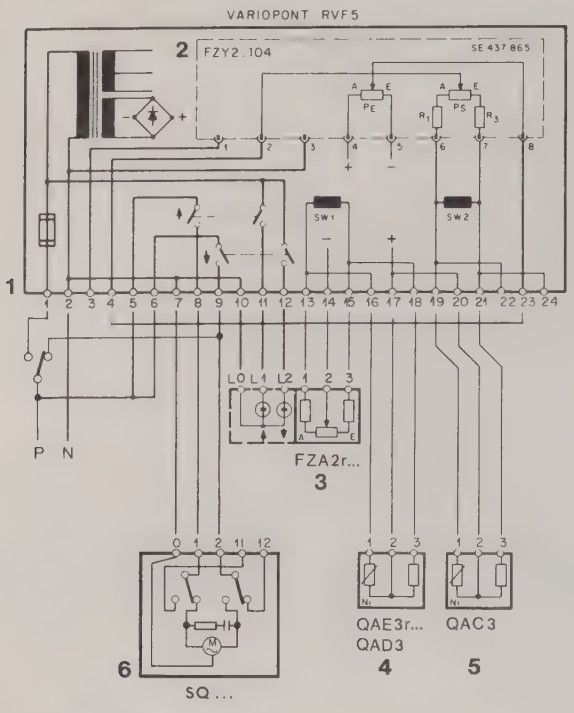
Set value of the compensator	Winter influence	Summer influence
20 . . . 22° C	10% (screw slot, scale 0 . . . 35%)	50% (screw slot, scale 0 . . . . 150%)

VARIOPONT Control System

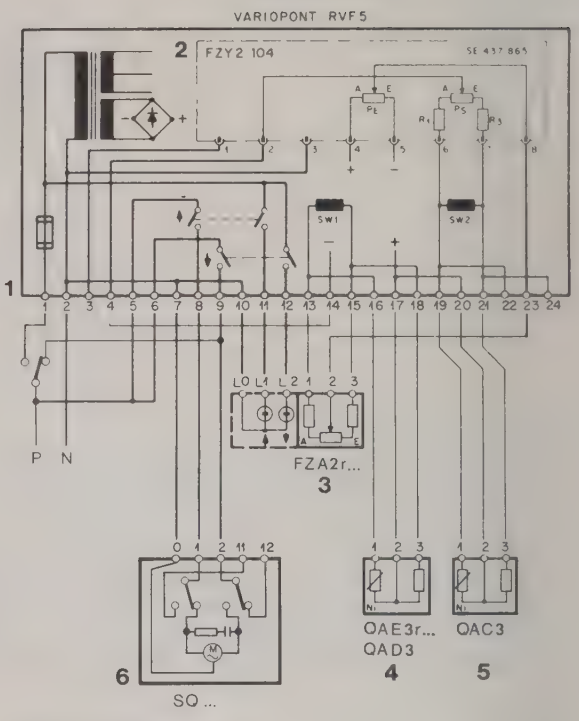
Diagram **8**

Outdoor temperature dependent control with small slope, or large slope

P+PI control with compensation

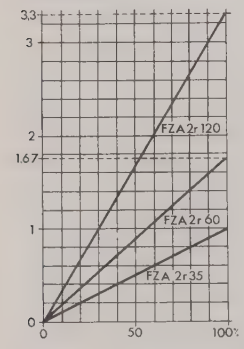


Circuit for small slope



Circuit for large slope

Small slope



Influence of the detector (5)

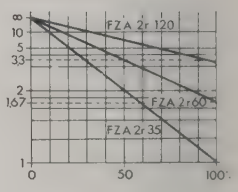
$$E = \frac{S \cdot 30}{Es} \cdot 100$$

List of control equipment

1. Controller Variopont RVF5
2. Plug-in unit FZY2.104 (inserted in controller)
   Scale 1 :Influence of the detector 0 . . . 100%
   Scale 2 : Setting range of the detector 0 . . . 30°C
3. Setting unit FZA2r35, FZA2r60, FZA2r120
4. Flow temperature detector QAE3r with pocket or QAD3
5. Outdoor temperature detector QAC3
6. Control motor of the type SQ . . .
   Running time approx. 2 minutes

S = Slope
Es = Adjusting of the setting unit (°C)
E = Influence of the detector (5)

Large slope



Influence of the detector (5)

$$E = \frac{Es}{S \cdot 30} \cdot 100$$

Application
Outdoor temperature dependent calorifier control or pre-control of the flow temperature for air heater batteries. Should a second heating programme be required for night operation, it is possible to change over to a second setting unit by means of a two-pole relay. This diagram serves only as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
The setting unit and the flow temperature detector 4 together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The outdoor temperature detector 5, together with the resistances R1, R3 and potentiometer PS in the plug-in unit form a second bridge circuit in the cross connection of which lies the control winding SW2 of the controller. The potentiometer PE in the plug-in unit is used for the adjustment of the influence of the outdoor temperature detector 5.
The set value Xd1 of the flow temperature detector 4 is selected by adjustment of the setting unit. The set value Xd2 of the outdoor temperature detector 5 (the «calibration» point) is set by means of the potentiometer PS in the plug-in unit. The influence E of the outdoor temperature detector 5 may be adjusted between the limits of 0 and 100% by means of the potentiometer PE in the plug-in unit; the flow temperature detector 4, on the other hand, has its full influence of 100%.

Setting instructions
The setting unit is used for setting the flow temperature required at a certain outdoor temperature, e.g. 10° C. With the right-hand knob of the plug-in unit is set the calibration point of the outdoor temperature, e.g. 10° C. With the right-hand knob of the plug-in unit is set the calibration point of the outdoor temperature Xd2 at which the flow temperature should attain the set value Xd1. In view of the fact that the slope must be allowed for in heating installations, it is necessary to calculate the adjustable influence settings in terms of slope. The influence setting for the desired slope can be read from the diagrams above. The resulting slope is actually dependent upon the setting unit used. If the required slope is greater than that shown in the diagram on the left, then the diagram on the right should be applied.
The thermal reset RF in the controller should be so adjusted that the flow temperature is regulated without any signs of hunting (approx. 20%).

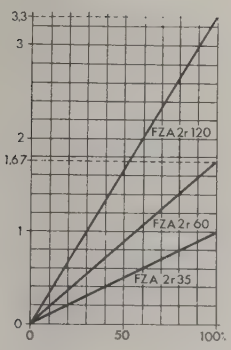
VARIOPONT Control System

Diagram **9**

Calorifier or flow temperature control, outdoor compensation and constant temperature

PI control with compensation

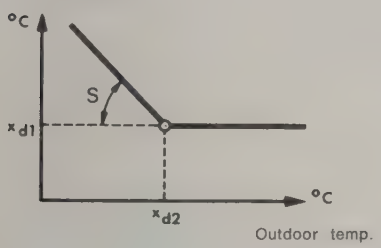
Slope



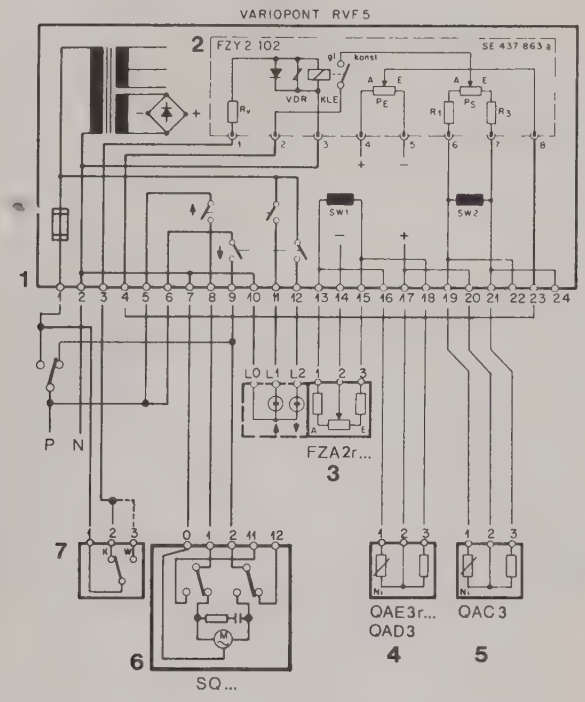
Influence of the detector (5) $E = \frac{S \cdot 30}{Es} \cdot 100$

S = Slope
Es = Adjustment span (°C) of the setting element
E = Influence of the detector

Flow temperature



Xd1 = Set value of the flow temperature
Xd2 = Set value of the outdoor temperature



List of control equipment

1. Controller RVF5
2. Plug-in unit FZY2.102 (inserted in controller)
   Scale 1 : Influence of the temperature detector 5 0 . . . 100%
   Scale 2 : Setting range of the temperature detector 5 0 . . . 30°C
3. Setting unit FZA2r35, FZA2r60, FZA2r120
4. Exhaust air temperature detector QAE3r . . . with flange
5. Outdoor air temperature detector QAE3r . . . with flange or outdoor temperature detector QAC3
6. Control motor of the type SQ . . .
   Running time approx. 2 minutes
7. Fresh-air or outdoor thermostats (7)

Application
Constant and compensated calorifier or flow temperature control in heating and ventilating plant.
This diagram serves only as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
This diagram corresponds in principle to the Diagram 8 for small slope but with the additional facility to switch over to a constant desired value Xd1 for the detector. The setting unit and the flow temperature detector 4 together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The outdoor temperature detector 5, the resistances R1, R3 and the potentiometer PS in the plug-in unit form a second bridge circuit, in the cross-connection of which lies the control winding SW2 of the controller. The potentiometer PE in the plug-in unit is for the selection of the influence settings for the temperature detector 5. The relay KLE in the plug-in unit is switched by an external thermostat. With the relay KLE energized both bridge circuits are operative, so that a compensated form of temperature control is achieved whereby the desired value of the temperature detector is displaced in relation to the outdoor temperature. When the relay KLE is de-energized the temperature detector is ineffective, so that the controller operates with a constant value Xd1, which is set on the setting unit. When using this circuit the flow temperature is controlled to a constant value when the outdoor temperature is high, whereas a lower outdoor temperature causes the flow temperature to be raised in a progressive manner. The changeover point from constant to compensated is determined by the setting of the outdoor temperature thermostat 7.

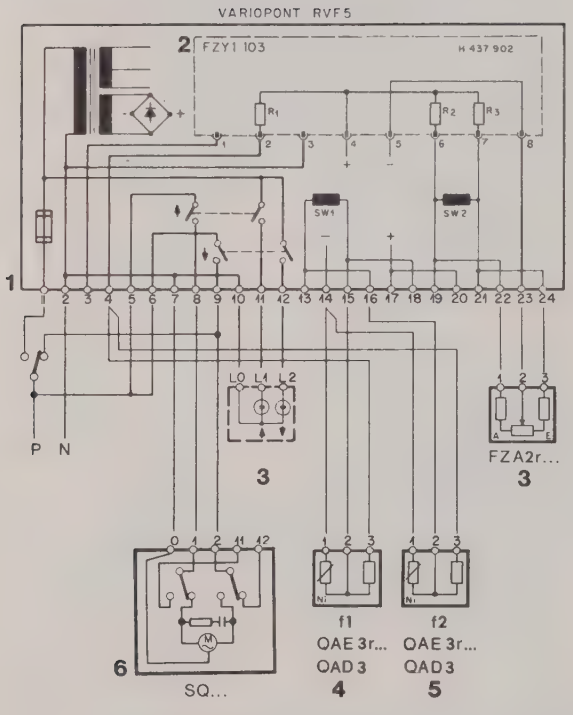
Setting instructions
The setting unit is used for setting the flow temperature required at a certain outdoor temperature, e.g. 10°C. With the right-hand knob of the plug-in unit is set the calibration point of the outdoor temperature Xd2 at which the flow temperature should attain the set value Xd1 (setting unit). In view of the fact that the slope must be allowed for in heating installations, it is necessary to calculate the adjustable influence setting terms of slope. The influence setting for the desired slope can be read from the above diagram. The resulting slope is actually dependent upon the setting unit used.
The thermostat T used for the changeover should have the smallest possible differential. It should be set to the same value as the calibration point for outdoor temperature Xd2 (e.g. 10°C).

VARIOPONT Control System

Diagram **10**

Temperature difference control

PI control



List of control equipment
1. Controller Variopont RVF5
2. Plug-in unit FZY1.103 (inserted in controller, non adjustable).
3. Setting unit FZA2r20 or FZA2r35
4. Temperature detector F1 100 ohms/0°C with nickel sensing element
5. Temperature detector F2 100 ohms/0°C with nickel sensing element
6. Control motor of the type SQ . . .
   Running time approx. 2 minutes

Application
This circuit is suitable for all control duties which involve the control of a temperature difference rather than a constant desired value. This diagram serves only as a basis for the connections of the control apparatus of the VARIOPONT system.

Description of the control function
By using this circuit it is possible to construct a control system which will maintain a constant temperature difference between two temperature detectors. Temperature detectors F1 and F2 together form a bridge circuit in the cross-connection of which lies the control winding SW1 of the controller. The setting unit together with resistances R2 and R3 in the plug-in unit form the second bridge circuit in the cross-connection of which lies the control winding SW2 of the controller. Resistance R1 on the plug-in unit is the series resistance for the first bridge circuit.
The temperature value set on the setting unit is the desired temperature difference. Temperature detector F1 must measure the higher temperature if the setting unit is set to a value exeeding 0°C.

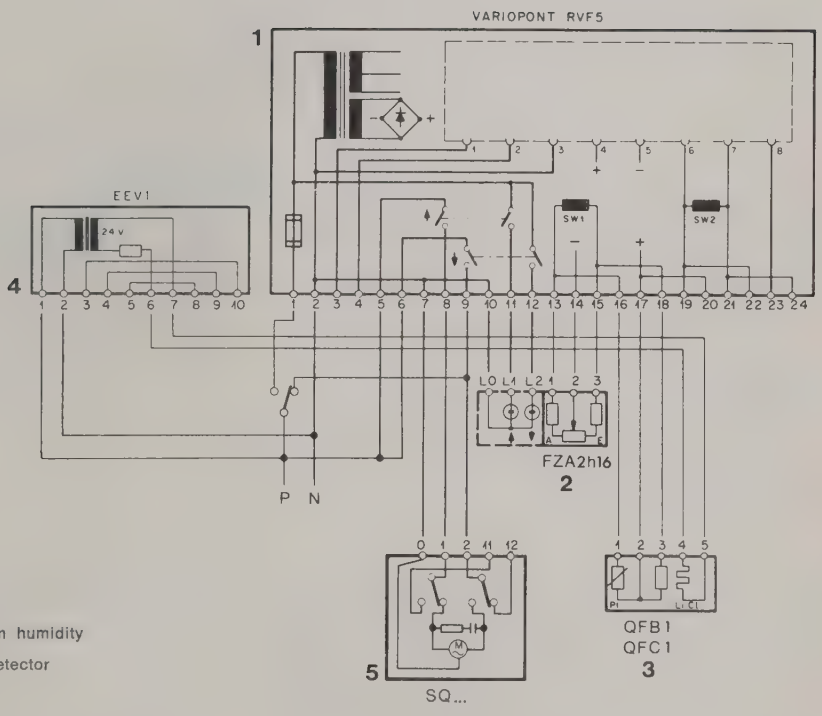
Setting instructions
The desired temperature difference is set by means of the setting unit. Thermal reset RF in the controller serves for stabilising the control process and must be set to match the characteristics of the installation.

VARIOPONT Control System

Diagram **11**

Control of absolute air humidity

PI control



List of control equipment
1. Controller VARIOPONT RVF5
2. Setting unit FZA2h16
   Scale 2 . . . 16 g H_2O/kg
3. Air duct humidity detector QFB1 or room humidity detector QFC1
4. Power-pack EEV1 for the air humidity detector
5. Control motor of the type SQ . . .
   Running time approx. 2 minutes

Application
Humidity control in ventilating installations.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
The air humidity detector contains an electrically heated lithium-chloride unit, the heating supply being obtained from the power-pack EEV1. The electrical resistance of the lithium-chloride unit, and thus also the temperature rise, depend upon the humidity of the air. The temperature of this unit thus forms an exact measure for the absolute air humidity and is measured with a platinum sensing element. Thus this circuit corresponds, in principle, to a temperature control system. The setting unit together with the platinum sensing element and the resistance in the air humidity detector combine to form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller.
It should be specially noted with this circuit that the connection for the power-pack EEV1 is to be made on the line side of the plant main switch. The lithium-chloride unit in the air humidity detector must be continuously heated; failing this the lithium-chloride layer will absorb excess water from the air and will dissolve.
Being of the PI type, the RVF5 controller is equipped with a built-in thermal reset device. This serves for stabilising the control action and should be adjusted to suit the characteristics of the plant.

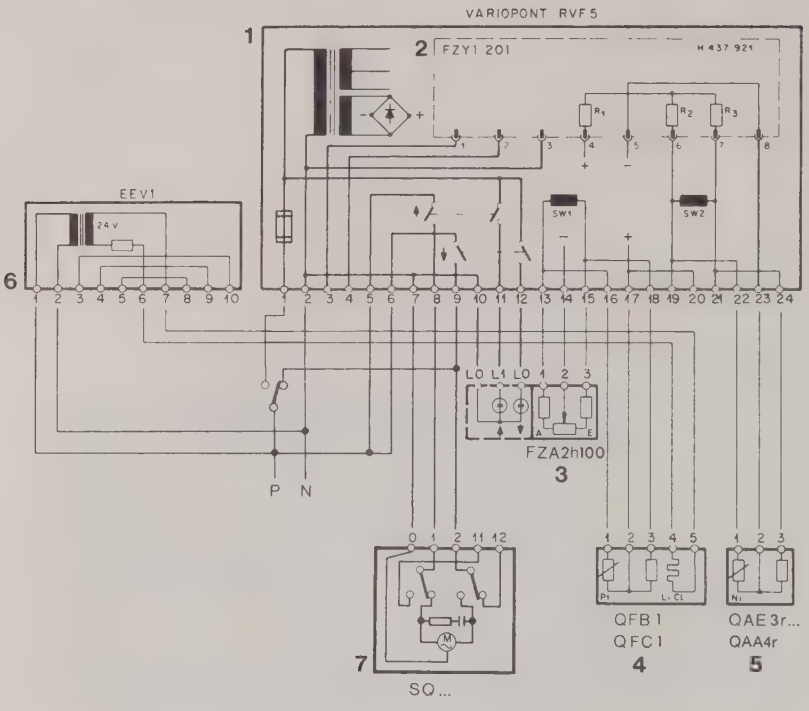
Setting instructions
The desired degree of humidity x, adjustable between 2 and 16 g water/kg dry air, may be set on the setting unit. The thermal reset RF in the controller should be adjusted to give control without evidence of hunting.

VARIOPONT Control System

Diagram **12**

Control of relative humidity

PI control



List of control equipment
1. Controller Variopont RVF5
2. Plug-in unit FZY1.201 (inserted in controller, not adjustable)
3. Setting unit FZA2h100
   Scale: 20 . . . 100% r.h.
4. Air duct humidity detector QFB1 or room humidity detector QFC1
5. Air duct temperature detector QAE3r . . . with flange, or room temperature detector QAA4r
6. Power-pack EEV1 for the humidity detector
7. Control motor of the type SQ . . .
   Running time approx. 2 minutes

Application
Humidity control in ventilating installations.
This diagram merely serves as a basis for the connections for the control apparatus of the VARIOPONT system.

Description of the control function
The humidity detector contains an electrically heated lithium-chloride unit, the heating supply for which is taken from a power-pack EEV1. The electrical resistance of the lithium-chloride unit, and thus also the degree of heating, varies according to the actual air humidity. The temperature of this unit forms an exact measure of the absolute humidity of the air and is measured with a platinum resistance thermometer. This circuit is similar in principle to that used for temperature control. As the air humidity sensing element measures only the absolute humidity an additional temperature detector is required for compensating purposes. The setting unit and the air humidity detector together form a bridge circuit in the cross-connection of which lies control winding SW1 of the control. The temperature detector together with resistances R2 and R3 in the plug-in unit combine to form a second bridge circuit in the cross-connection of which lies control winding SW2 of the controller. Resistance R1 in the plug-in unit is the series resistance for the second bridge and determines the influence of temperature detector 5.
It should be specially noted with this circuit that the mains supply for the power-pack type EEV1 should be obtained from the supply side of the mains switch of the plant. The air humidity detector must remain permanently heated, otherwise the lithium-chloride layer will absorbe an excess of moisture from the air and dissolve. Being of the PI- type, the RVF5 controller is equipped with a thermal reset arrangement. This serves for stabilizing the control function and must be adjusted to match the characteristics of the installation.

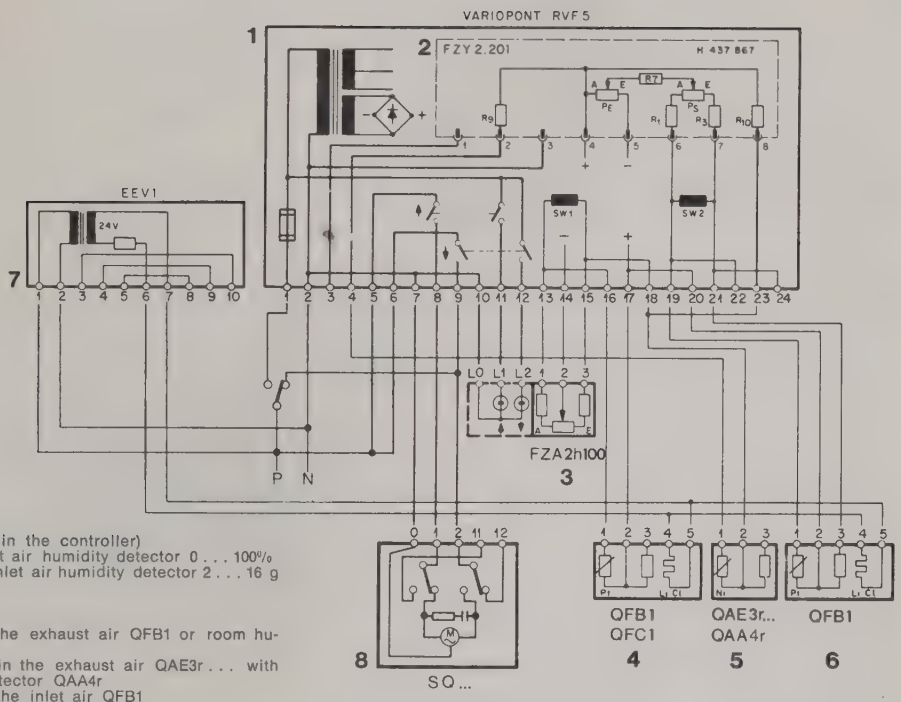
Setting instructions
The setting unit may be set to relative humidity values of between 20 . . . 100%. The thermal reset RF in the controller should be adjusted to give operation, free of hunting.

VARIOPONT Control System

Diagram **13**

Anticipatory control of room humidity

P+PI control



List of control equipment
1. Controller Variopont RVF5
2. Plug-in unit FZY2.201 (inserted in the controller)
   Scale 1 : Influence of the inlet air humidity detector 0 . . . 100%
   Scale 2 : Setting range of the inlet air humidity detector 2 . . . 16 g H_2O/kg air
3. Setting unit FZA2h100
   Scale : 20 . . . 100% r.h.
4. Air duct humidity detector in the exhaust air QFB1 or room humidity detector QFC1
5. Air duct temperature detector in the exhaust air QAE3r . . . with flange or room temperature detector QAA4r
6. Air duct humidity detector for the inlet air QFB1
7. Power-pack EEV1 for air humidity detector
8. Control motor of the type SQ . . .
   Running time approx. 2 minutes

Application
This circuit serves for control duties in ventilating installations when a PI control of the relative air humidity in the room cannot be used because of difficulties in achieving stability.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
The air humidity detector 4 is used in conjunction with the temperature detector 5 for measurement of the relative humidity of the room. Air humidity detector 6 measures the absolute humidity of the incoming air. This circuit involves the use of three detectors, but only two bridge circuits are available, and therefore two detectors are supplied to the first bridge circuit. The setting unit, the platinum resistance of the air humidity detector 4, the nickel resistance of the temperature detector 5 and resistance R9 and R10 in the plug-in unit together form a bridge circuit in the cross-connection of which lies the control winding SW1 of the controller. Resistance R9 in the plug-in unit is the series resistance for the nickel sensing element, and resistance R10 shunts both of these. This circuit enables the relative humidity to be determined with a single bridge circuit. Air humidity detector 6 together with resistances R1 and R3 and the potentiometer in the plug-in unit together form a second bridge circuit in the cross-section of which lies the control winding SW2 of the controller. Potentiometer PS serves for the adjustment of the value Xd2. The influence of the detector 6 may be adjusted by means of the potentiometer PE in the plug-in unit.
The power-pack EEV1 provides a supply for the heating elements of the humidity detector 4 and 6. It should be noted in connection with this circuit that the power-pack EEV1 should be connected on the supply side of the plant main switch. Once the lithium-chloride units have been removed from their air-tight packages, they must be kept continuously heated, otherwise the lithium-chloride layer will absorb excessive moisture and dissolve.
With this «Anticipatory» control circuit the desired value of the inlet air humidity detector 6 is varied in relationship to the relative humidity of the room air. When the relative air humidity in the room deviates from the set value Xd1 the desired value of the inlet air humidity detector 6 is varied in a sense opposite to that of the change in the room air humidity.
In view of the fact that the controller corrects a deviation in room humidity by giving a proportional adjustment of the inlet air humidity, the control it affords is comparable with that of a proportional controller. Due to the presence of the thermal reset the effect of the controller on the inlet air humidity is of the PI type. Disturbances in the humidity of the inlet air are thus corrected before they can effect the room humidity. Such a form of control is comparable in principle with the room temperature control system for ventilating plant show in Diagram 5.

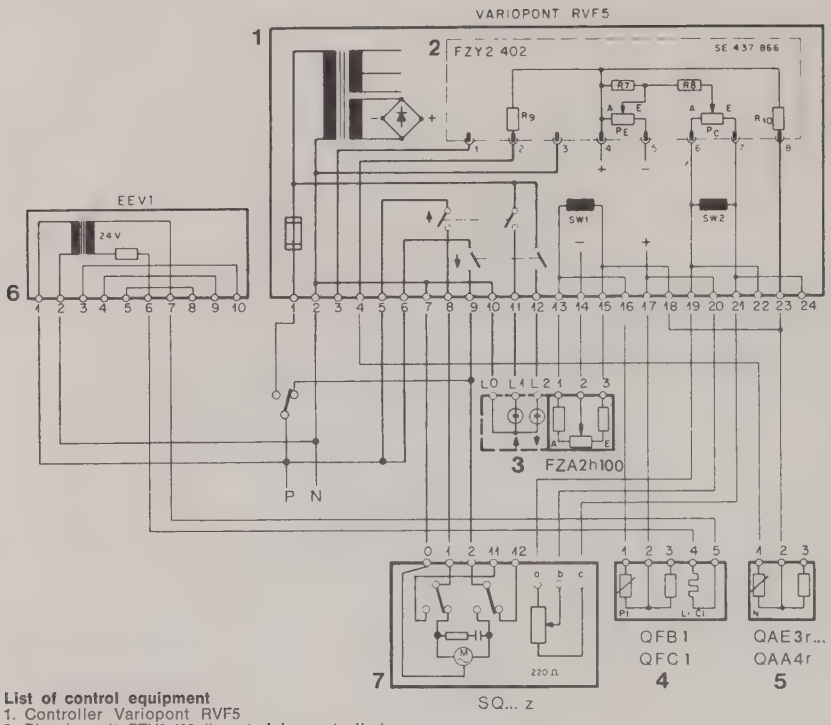
Setting instructions
The desired relative humidity of the air in the room is set on the setting unit. The plug-in unit in the controller is set to give the value of the inlet air humidity which is required to maintain the room humidity at the desired value. The influence of the inlet air humidity detector 6 is also adjusted by means of the plug-in unit in the controller. This value depends on the nature and the loading of the installation. The smaller the influence the greater must be the change of inlet air humidity to achieve a correction of the room air humidity, i.e. a disturbance in the room humidity is corrected as rapidly as is possible. The greater the influence the more will be the control.
The thermal reset RF in the controller should be adjusted to give control of the inlet air humidity free of hunting.

VARIOPONT Control System

Diagram **14**

Control of the relative humidity

P control



List of control equipment

1. Controller Variopont RVF5
2. Plug-in unit FZY2.402 (inserted in controller)
   Scale 1 : Proportional band 0 . . . 50%
   Scale 2 : Corr. Position of the P-band in reference to the desired value
3. Setting unit FZA2h100
   Scale: 20 . . . 100% r.h.
4. Air duct humidity detector QFB1 or room humidity detector QFC1
5. Air duct temperature detector QAE3r . . . with flange, or room temperature detector QAA4r
6. Power-pack EEV1 for the air humidity detector
7. Control motor of the type SQ . . . z with built-in feedback potentiometer 220 ohms
   Running time approx. 2 minutes

Application

Humidity control in ventilating installations.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function

The air humidity detector contains an electrically heated lithium-chloride unit, the heating supply for which is obtained from the power-pack EEV1. The electrical resistance of the lithium-chloride unit, and thus also the heating of the same, varies with the actual air humidity. The temperature of this unit is an accurate measure of the absolute air humidity and is measured by means of a platinum resistance thermometer. This circuit is analogous in principle to a temperature control circuit. As the air humidity detector by itself only measures the absolute air humidity an additional temperature detector is required for compensating purposes.
The setting unit, the platinum winding of air humidity detector 4, the nickel winding of the temperature detector 5 and the resistances R9 and R10 in the plug-in unit together form a bridge circuit in the cross-section of which lies the control winding SW1 of the controller. Resistance R9 in the plug-in unit is the series resistance for the nickel winding, while resistance R10 shunts both of these. This circuit enables the relative humidity to be measured with a single bridge circuit. The feedback potentiometer in the control motor and potentiometer PS in the plug-in unit together form a second bridge circuit in the cross-connection of which lies the control winding SW2 of the controller. The influence of the second bridge circuit can be adjusted by means of the potentiometer PE on the plug-in unit. This adjustable influence is the proportional range Xp. Potentiometer PS in the plug-in unit is marked «Corr.» and serves for the displacement of the proportional range.
The power-pack EEV1 must be connected on the supply side of the main switch of the installation. This arrangement is necessary because the lithium-chloride units must remain permanenty heated once they are removed from their air-tight packages. In the absence of heating the lithium-chloride units would absorb excess moisture and dissolve, thus becoming useless. Proportional control is obtained by the action of the reset in conjunction with the feedpack potentiometer in the control motor and the plug-in unit. In other respects the second paragraph of the control function description given with Diagram 3 is valid for the P-control function.

Setting Instructions

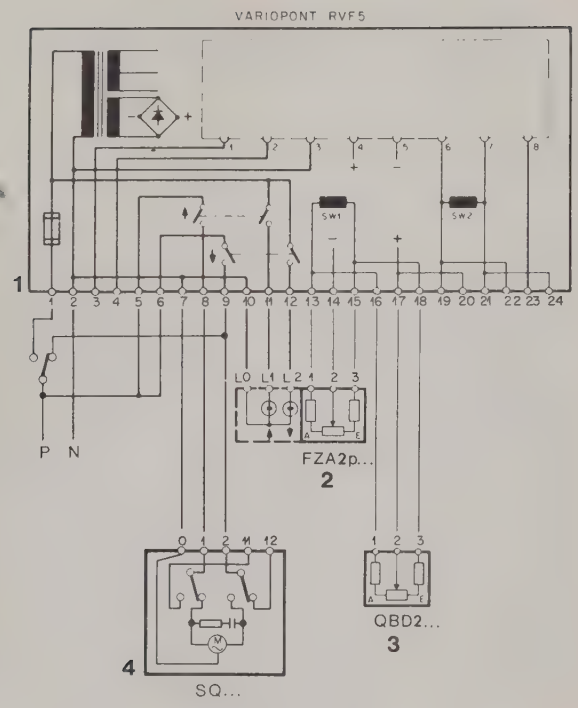
The desired value of the relative humidity of the air is set on the setting unit. The proportional range must be set to a sufficiently large value on the plug-in unit to give stable control. If the control deviates from the set value Xd1, setting unit, correction can be obtained by adjusting the knob «Corr.» on the plug-in unit. It should, however, be noted that this calibration can only hold good in one particular position of the control motor drive; as soon as the load on the installation changes, causing the control motor to assume a new position, a further deviation will arise depending on the set proportional range Xp. This is a characteristic feature of proportional control.
Setting knob RF in the controller should be set to 0 for proportional control.

VARIOPONT Control System

Diagram **15**

Pressure control

PI control



List of control equipment
1. Controller Variopont RVF5
2. Setting unit FZA2p . .
3. Pressure detector QBD2 . .
4. Control motor of the type SQ . .
   Running time approx. 2 minutes

Application
Pressure control for water, steam, air and neutral gases. This circuit may also be used for pressure control of Freon refrigerants when applied in conjunction with pressure detector QBD2.6.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
This diagram shows the simplest circuit for use of a potentiometer-type sensing element in conjunction with the VARIOPONT RVF5. The pressure detector is equipped with a built-in potentiometer which moves in accordance with changes in pressure. The setting unit and the potentiometer in the pressure detector together form a bridge circuit in the cross-connection of which lies the control winding SW1 of the controller. In other respects, the control function description given with Diagram 1 applies also to this circuit.

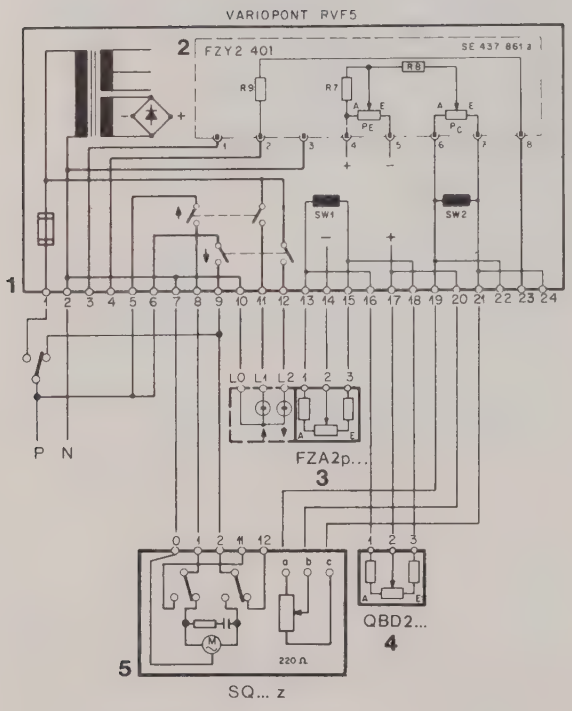
Setting instructions
Both the desired value and the thermal reset RF in the controller are adjustable. The control process may thus be stabilised and the adjustment should be made to match the characteristics of the installation.

VARIOPONT Control System

Diagram **16**

Pressure control

P control



List of control equipment

1. Controller Variopont RVF5
2. Plug-in unit FZY2.401 (inserted in controller)
   Scale 1 : Proportional band 0 . . . 100%
   Scale 2 : Corr. Position of the P-band in reference to the desired value
3. Setting unit FZA2p . .
4. Pressure detector QBD2 . . .
5. Control motor of the type SQ . . . z with built-in feedback potentiometer 220 ohms
   Running time approx. 2 minutes

Application
Storage filling control in steam boiler plant. Pressure control for water, steam, air and neutral gases. This circuit can also be used for the pressure control of Freon refrigerants in conjunction with the pressure detector QBD2.6.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
This diagram shows proportional control using a potentiometer-type sensing element. The detector is equipped with a built-in potentiometer, which moves in accordance with changes in pressure. The setting unit and the potentiometer in the pressure detector together form a bridge circuit, in the cross-connection of which lies control winding SW1 of the controller. The feedback potentiometer in the control motor and the potentiometer PS in the plug-in unit combine to form a second bridge circuit, in the cross-connection of which lies control winding SW2 of the controller. The proportional range may be adjusted by means of potentiometer PE in the plug-in unit while the potentiometer PS (marked «Corr.») is used for the displacement of the proportional range. In other respects the circuit is subject to the description given for Diagram 3.

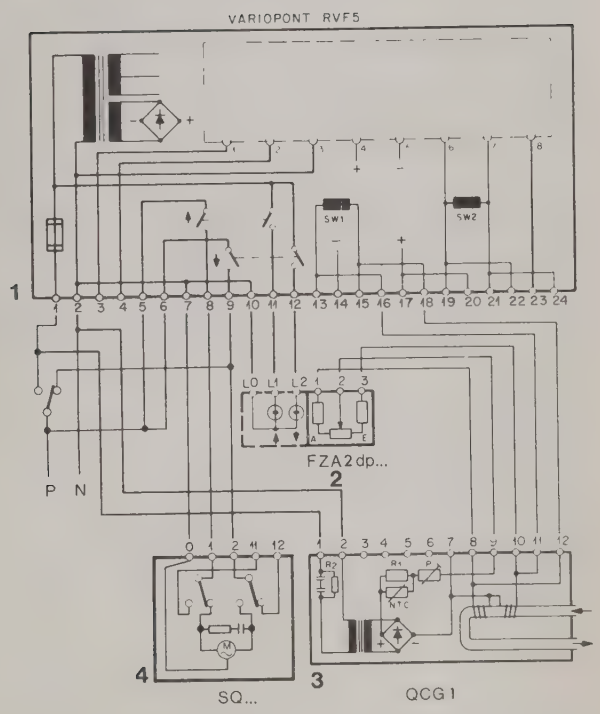
Setting instructions
The setting unit serves for the adjustment of the value Xd1. The proportional band Xp may be set by means of the left-hand setting knob of the plug-in unit. If the controlled value (actual value) deviates from the set value Xd1 (setting unit), correction can be made with the knob marked «Corr.». The setting knob RF in the controller should be set to 0 for proportional control.

VARIOPONT Control System

Diagram **17**

Pressure difference control

PI control



List of control equipment
1. Controller Variopont RVF5
2. Setting unit FZA2dp100 or FZA2dp50
   Scale : 0 . . . 100% Δp or —50 . . . +50% Δp
3. Pressure difference detector QCG1 (range is detemined by orifice used)
4. Control motor of the type SQ . . .
   Running time approx. 2 minutes

Application
The control of small positive or negative pressures in ventilated rooms, pressure control in large air duct systems, draught control for boilers operating with negative pressure in the combustion chamber, etc.
This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function
The pressure difference detector is provided with its own built-in power-pack and therefore requires a mains supply. The pressure difference between the two connections gives rise to a flow in the metering tube. The metering tube is equipped with two heated nickel windings which are cooled in a differential manner when there is a flow. The two nickel windings and the setting unit together form a bridge circuit in the cross-connection of which lies control winding SW1 of the controller.
The pressure differential detector is really a form of temperature difference measurement. The range is determined by a replaceable orifice. The detector contains no moving parts.

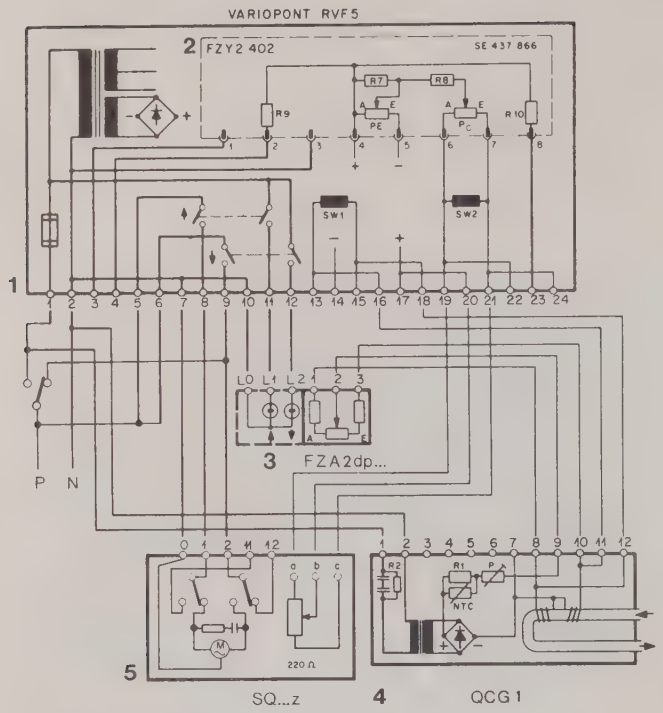
Setting instructions
Setting units for this equipment are calibrated in terms of percentage. Such calibration refers to the particular range orifice fitted to the pressure differential detector. The thermal reset RF in the controller serves for stabilising the control action and must be adjusted to match the characteristics of the installation.

VARIOPONT Control System

Diagram **18**

Pressure difference control

P control



List of control equipment

1. Controller Variopont RVF5
2. Plug-in unit FZY2.402 (inserted in controller)
   Scale 1 : Proportional band 0 . . . 50%
   Scale 2 : Corr. Position of the P-band in reference to the desired value
3. Setting unit FZA2dp100 or FZA2dp50
   Scale : 0 . . . 100% △p or —50 . . . +50%△p
4. Pressure difference detector QCG1 (range is determined by orifice used)
5. Control motor of the type SQ . . z with built-in feedback potentiometer 220 ohms
   Running time approx. 2 minutes

Application

Control of small positive pressures and negative pressures in ventilated rooms, pressure control in large air duct systems, draught control for boilers operating with negative pressure in the combustion chamber, etc.

This diagram merely serves as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function

The pressure difference detector is provided with its own built-in power-pack and therefore requires a mains supply. The pressure difference between the two connections gives rise to a flow in the metering tube. The metering tube is equipped with two heated nickel windings which are cooled in a differential manner when there is a flow. The two nickel windings and the setting unit together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The feedback potentiometer of the control motor and potentiometer PS in the plug-in unit combine to form a second bridge circuit, in the cross-connection of which lies the control winding SW2 of the controller. The influence of the second bridge circuit can be adjusted by means of the potentiometer PE in the plug-in unit. This adjustable influence is the proportional range Xp. Potentiometer PS in the plug-in unit is marked «Corr.» and serves for the displacement of the proportional range. In other respects the second paragraph of the description given with Diagram 3 is also valid for this P-control system.

The pressure differential sensing element is really a form of temperature difference measurement. The range is determined by an exchangeable orifice. There are no moving parts in the detector.

Setting instructions

Setting units for this system are calibrated in terms of percentage. Such calibration refers to the particular range-orifice fitted to the pressure differential detector. Every range of measurement can be met by use of one of the two setting units shown in the «List of control equipment».

The set value Xd1 is set on the setting unit. The proportional range, 0 . . . 50%, may be set by means of the left-hand setting knob of the plug-in unit. If the controlled value (actual value) differs from the set value Xd1 (setting unit), corrections can be made with the adjusting knobe marked «Corr.». It should be noted that this calibration can only hold good in one particular position of the control motor. As soon as the load of the installation changes, with the result that the control motor assumes a new position, a new deviation will occur, depending on the set proportional range Xp. This variation is characteristic of proportional control systems.

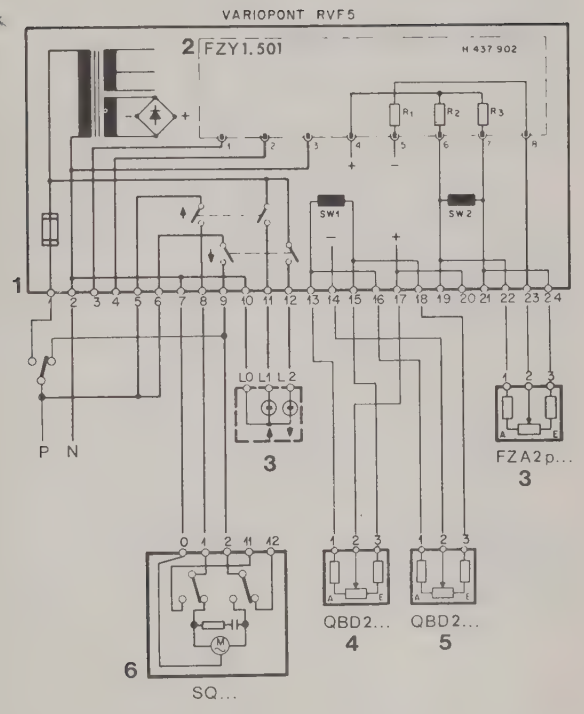
The setting knob RF in the controller should be set to 0 with proportional control.

VARIOPONT Control System

Diagram **19**

Pressure difference control with two detector QBD...

PI control



List of control equipment

1. Controller Variopont RVF5
2. Plug-in unit FZY1.501 (inserted in controller, not adjustable)
3. Setting unit FZA2p5 with adhesive label X 10 m WS/CE } Pressure difference 0 . . . 50 m WS
4. Pressure detector QBD2.20 } 0 . . . 50 m CE
5. Pressure detector QBD2.20 }

3. Setting unit FZA2p1 with adhesive label X 10 m WS/CE } Pressure difference 0 . . . 10 m WS
4. Pressure detector QBD2.5 } 0 . . . 10 m CE
5. Pressure detector QBD2.5 }
6. Control motor of the type SQ . . . Running time approx. 2 minutes

Application

Control of larger pressure differences, e.g. in district heating systems.

This diagram serves only as a basis for the connections between the control apparatus of the VARIOPONT system.

Description of the control function

With this circuit it is possible to provide a control system with which a constant pressure difference between two pressure detectors is maintained. Both pressure detectors together form a bridge circuit, in the cross-connection of which lies the control winding SW1 of the controller. The setting unit together with the resistances R2 and R3 combine to form a second bridge circuit, in the cross-connection of which lies the control winding SW2 of the controller.

The pressure setting selected on the setting units gives the desired pressure difference.

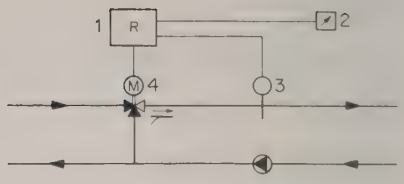
The combination of two pressure detectors QBD2.5 with setting unit FZA2p1 (with adhesive label X 10 m WS) gives a pressure differential range from 0 . . . 10 m WS. If a larger range is required then 2 pressure detectors QBD2.20 together with the setting unit FZA2p5 (with adhesive label X 10 WS) should be used. The setting range for the pressure differential then becomes 0 . . . 50 m WS.

Setting instructions

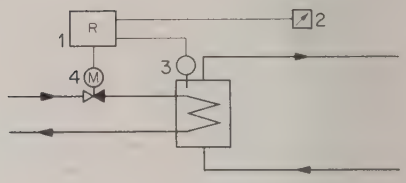
The required pressure difference (desired value) is selected in m WS pressure on the setting unit. Besides the desired value, the thermal reset RF can also be adjusted. It serves for stabilising the control action and must be matched to the installation by corresponding adjustment.

Application examples for diagrams 1 . . . 19

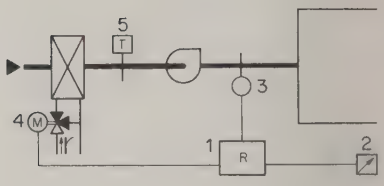
Temperature control as with diagram 1
Flow temperature control for LPHW installations
1 Controller
2 Setting unit
3 Flow temperature detector
4 Motorised valve



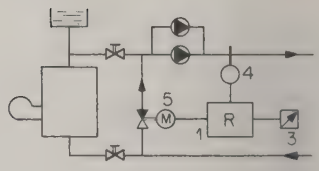
Calorifier control
1 Controller
2 Setting unit
3 Immersion temperature detector
4 Motorised valve



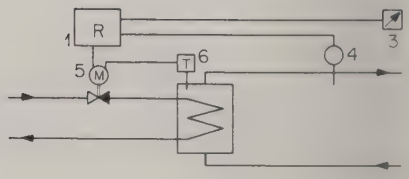
Supply air temperature control
1 Controller
2 Setting unit
3 Inlet air temperature detector
4 Motorised valve
5 Frost protection thermostat



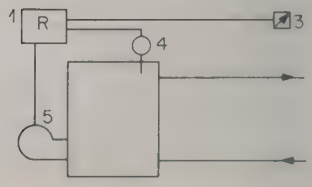
HPHW installation, flow temperature control as with diagram 2
1 Controller
3 Setting unit
4 Flow temperature detector
5 Motorised valve



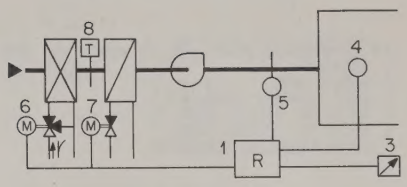
Calorifier control as with diagram 3
1 Controller
3 Setting unit
4 Flow temperature detector
5 Motorised valve
6 High limit thermostat



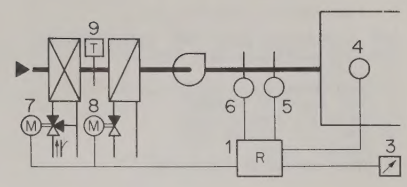
HPHW boiler, temperature control as with diagram 4
1 Controller
3 Setting unit
4 Immersion temperature detector
5 Oil or gas burner



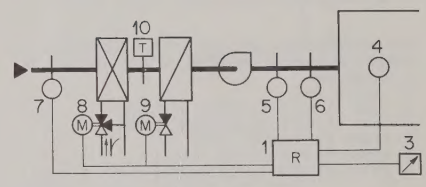
Ventilating plant, anticipatory room temperature control as with diagram 5
1 Controller
3 Setting unit
4 Room temperature detector
5 Inlet air temperature detector
6 Motor for heating valve
7 Motor for cooling valve
8 Frost protection thermostat



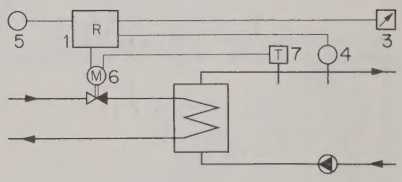
Ventilating plant, anticipatory room temperature control with low limitation of the supply air temperature as with diagram 6
1 Controller
3 Setting unit
4 Room temperature detector
5 Inlet air temperature detector
6 Low limiter for supply air temperature
7 Motor for heating valve
8 Motor for cooling valve
9 Frost protection thermostat



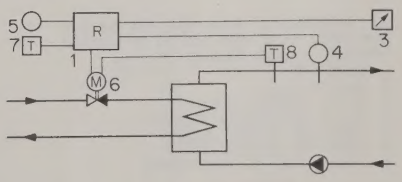
Ventilating plant, anticipatory room temperature control with low limitation of the supply air temperature and outdoor temperature compensation as with diagram 7
1 Controller
3 Setting unit
4 Room temperature detector
5 Inlet air temperature detector
6 Low limiter for supply air temperature
7 Outdoor temperature compensator
8 Motor for heating valve
9 Motor for cooling valve
10 Frost protection thermostat



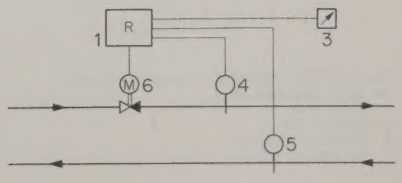
Calorifier control, compensated in accordance with outdoor temperature as with diagram 8
1 Controller
3 Setting unit
4 Flow temperature detector
5 Outdoor detector
6 Motorised valve
7 High limit thermostat



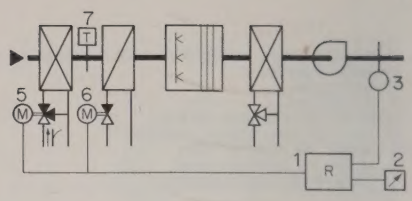
Calorifier control constantly compensated in accordance with outdoor temperature as with diagram 9
1 Controller
3 Setting unit
4 Flow temperature detector
5 Outdoor detector
6 Motorised valve
7 Outdoor thermostat
8 High limit thermostat



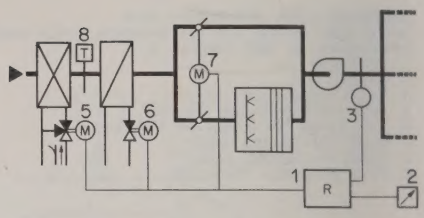
District heating, temperature difference control as with diagram 10
1 Controller
3 Setting unit
4 Flow temperature detector
5 Return temperature detector
6 Motorised valve



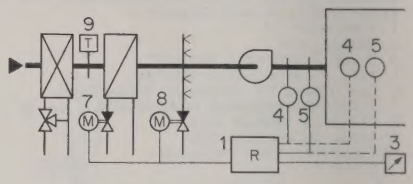
Air conditioning plant with air washer as with diagram 11
1 Controller
2 Setting unit
3 Duct humidity detector
5 Motor for heating valve
6 Motor for cooling valve
7 Frost protection thermostat



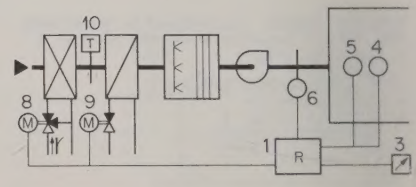
Air conditioning plant with washer bypass, humidity control as with diagram 11
1 Controller
2 Setting unit
3 Duct humidity detector
5 Motor for heating valve
6 Motor for cooling valve
7 Damper motor
8 Frost protection thermostat



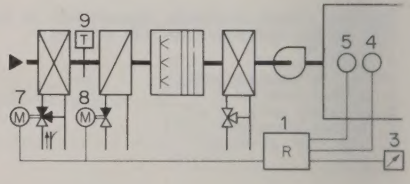
Air conditioning plant with steam humidifier, control of relative humidity as with diagram 12
1 Controller
3 Setting unit
4 Duct or room humidity detector
5 Duct or room temperature detector
7 Motor for cooling valve
8 Motor for humidifying valve
9 Frost protection thermostat



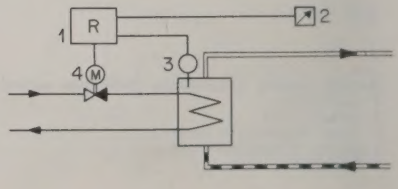
Air conditioning plant with air washer, anticipatory humidity control as with diagram 13
1 Controller
3 Setting unit
4 Room humidity detector
5 Room temperature detector
6 Duct humidity detector
8 Motor for heating valve
9 Motor for cooling valve
10 Frost protection thermostat



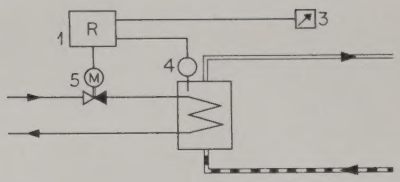
Air conditioning plant with air washer, ventilating plant with control of relative humidity as with diagram 14
1 Controller
3 Setting unit
4 Room humidity detector
5 Room temperature detector
7 Motor for heating valve
8 Motor for cooling valve
9 Frost protection thermostat



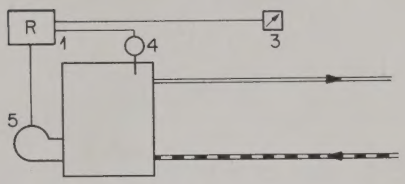
Steam/HPHW calorifier, pressure control as with diagram 15
1 Controller
2 Setting unit
3 Pressure detector
4 Motorised valve



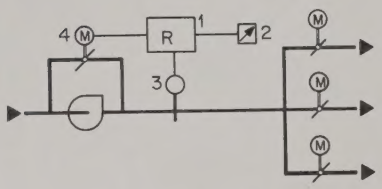
Steam/HPHW calorifier, pressure control by rapid load alterations as with diagram 16
1 Controller
3 Setting unit
4 Pressure detector
5 Motorised valve



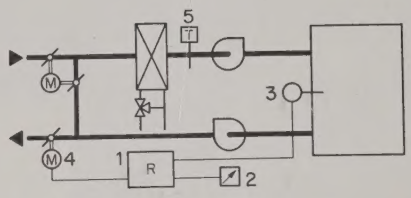
Steam boiler, pressure control as with diagram 16
1 Controller
3 Setting unit
4 Pressure detector
5 Oil or gas burner



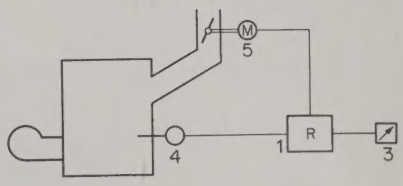
Ventilating plant, pressure difference control as with diagram 17
Control of static pressure in air duct
1 Controller
2 Setting unit
3 Pressure detector
4 Damper motor



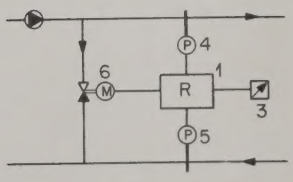
Control of static pressure in the room
1 Controller
2 Setting unit
3 Pressure detector
4 Damper motor
5 Frost protection thermostat



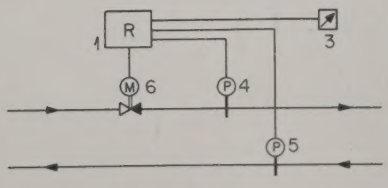
Heating boiler pressure difference control as with diagram 18
Combustion chamber draught control
1 Controller
3 Setting unit
4 Pressure detector
5 Damper motor



Pressure difference control between flow and return as with diagram 19
1 Controller
3 Setting unit
4 Pressure detector in flow
5 Pressure detector in return
6 Motorised valve



1 Controller
3 Setting unit
4 Pressure detector in flow
5 Pressure detector in return
6 Motorised valve



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